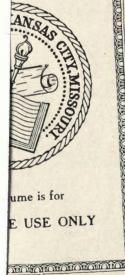


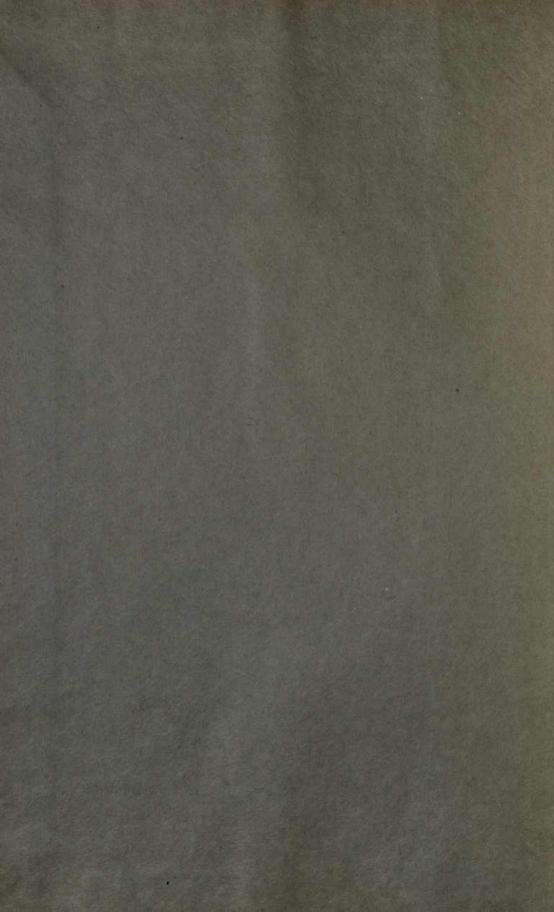
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THE

IRRIGATION AGE

(ILLUSTRATED)

JANUARY-JUNE, 1896

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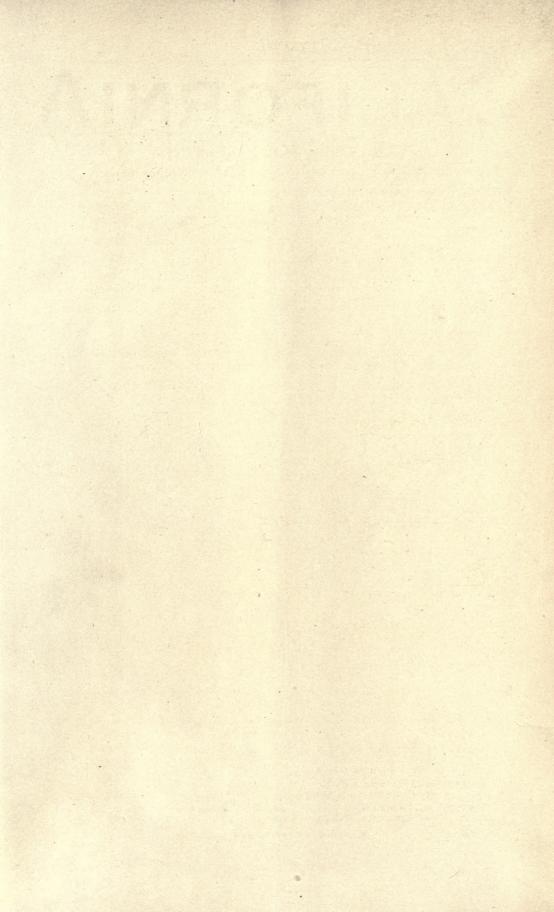
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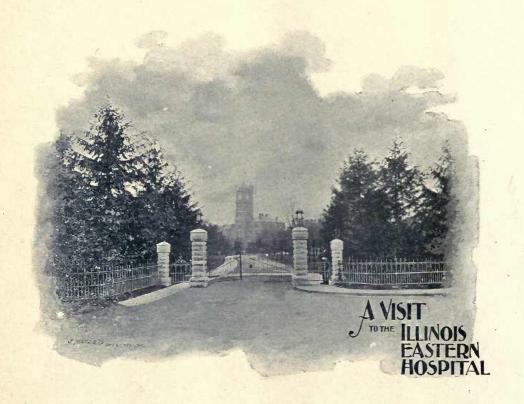
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THE IRRIGATION AGE.

VOL. IX.

CHICAGO, JANUARY, 1896.

No. 1.

ILLINOIS LEADS THE WAY.

IRRIGATION NECESSARY IN THE MOST FERTILE STATES.

IRRIGATION in Illinois is an established fact, and the advantages of this safe, sure method of farming are demonstrated in a most substantial way. Fertile as is the soil of this State and beautiful as are the crops when there is sufficient rain, it is conclusively shown that crops on irrigated land are fourfold greater; and when there are seasons of drought, and the crops on the old-fashioned farms prove partial or total failure, there is of course no longer any comparison at all between the two systems of farming, for irrigated crops never fail.

The drought of the past season, with its disastrous effects for the farmers of this and other central Western States, together with meager reports of most wonderful results on an irrigated farm near Kankakee, Ill., have combined to create a perfect furore among the agricultural classes. Farm-owners and working farmers from long distances visit this irrigated farm, and letters and inquiries from points in this and other States are so numerous that they can not be answered.

One day recently a representative of The Irrigation Age made a flying visit to Kankakee, and drove out to the irrigated farm. It is a State institution, and thus Illinois has officially adopted irrigation, and points out the way of salvation to all her sister States of the central West, the East and South. It is evident that the age of prayers for rain is a period of the past.

In 1894 the crops on the 1,000-acre farm of the Eastern Illinois Hospital for the Insane were ruined by drought, and the hospital management paid out \$15,000 for vegetables, fruit, etc. The past season of 1895 was again dry, but there was such an abundant yield that not a dollar will have to be expended, and 2,000 bushels of turnips alone have been fed to the cattle. Irrigation of 150 acres, used for garden and orchard, brought about the change, and the expenditure for the irrigating plant, making watering possible, was only \$1,500. The innovation was suggested and urged by Dr. Clarke Gapen, the superintendent of the asylum, who is a reader of THE IRRIGATION AGE, and through the co-operation of the board it was carried

Numerous questions were asked by the visitors, all of which were cheerfully answered by Superintendent Gapen and his assistants as they showed the people around. In 1894, of forty acres planted to potatoes, the crop did not return sufficient to make good the seed. The cabbages were dried up, vegetables of all kinds were little better than stalks, and small fruit withered, all because of the lack of water. It was this condition of things that prompted the resort to irrigation, and the great success achieved commends the decisive step taken.

The work of preparing for irrigation was commenced late in the spring of this year. The plan was to extend the regular water works of the institution so as to irrigate 150 acres of land for garden and orchard. Pipes were laid from the Kankakee river, and ditches dug in the tract.

The pumps lift the water about twentyfive feet. A Blake pump, with a capacity of 3,000,000 gallons per day, and a Worthington pump, with a capacity of 2,500,000 gallons per day, now furnish the supply of water for 3,000 patients and the entire institution, and also the water for irrigating 150 acres of land, 100 acres for garden and 50 acres for orchard. A 10-inch pipe that carries water to the hospital was utilized for a distance. Then 1,200 feet of 6-inch main was laid to the highest point on the grounds of the asylum, about half a mile west of the buildings. This point is twenty-five feet above the average level of the river. From the summit, 2,000 feet of 4-inch and 800 feet of 3-inch pipe were run to various parts of the garden. At intervals hydrants were put in. A ditching plow was used to make the furrows where water was to be turned on, and these furrows were connected with the hydrants by short sections of hose. pumps are only run to their full capacity when the irrigation work is being carried They consume from twelve to fifteen tons of coal per day when running at full capacity. It was about the first of June before the mains and ditches were ready. Superintendent Gapen is confident that if they had been finished a couple of weeks earlier, the results would have been still more remarkable. The land was given but one thorough irrigation during the season. After being pumped to the highest point, the water is run in open ditches over the greater area of the tract. About a month was required to cover the 150 acres. Certain sections of the garden, such as the onion bed, were flooded instead of being ditched. By a system of sheet-iron dams, the streams in the ditches are kept under control and the water is sent just where it is wanted. The ditches are small, and when the pumps are working at full force, the depth of the water in most of them is but two or three inches. The superintendent estimates that 100,000 gallons of water to the acre are necessary for the season.

The visitors were astonished to learn that seven crops of peas were raised. Of radishes and other vegetables there were also tremendous crops. Raspberry and blackberry bushes which were set out in the spring bore fruit. Of 1,000 cherry trees planted this season not one died. "Our potato patch," continued Superin-

tendent Gapen, "was the finest in Illinois. In one patch we had 120,000 heads of cabbage, every one of them huge, hard and perfect. Last year we had to buy 100 carloads of vegetables; this year, through irrigation, we have such a quantity that we can hardly get rid of it."

The superintendent added that he was ably assisted in the practical irrigation work by Mr. W. F. Harris, formerly of Orange, Cal., who is familiar with irrigation from a long experience in his native

tate.

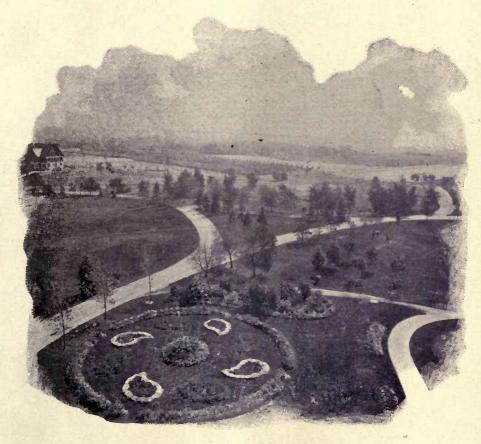
The party were then escorted to the office of Dr. Gapen, where they were shown a tabulated list of the products grown on these 100 acres of irrigated land in 1895, and there was not only astonishment but the greatest enthusiasm for irrigation. The figures were:

	Acres.	Barrels.
Beets	4	1,960
Cabbage	15	1,498
Cauliflower	3	81
Cucumber (bu.)	3/4	184
Lettuce	34	101
Watermelons (No.)	1	13,055
Muskmelons (No.)	7	2,940
Onions	3	255
Peas		259
Radishes		304
Tomatoes (bu.)	6	1,360
Turnips (bu.)	15	3,035
Potatoes (bu.)	25	3,714
Greens	21/2	500
Rhubarb		261
	12	

The value of these vegetables was generally \$15,000, and as the gardens elsewhere were failures, on account of the extended drought, it is practically a gain of \$150 an acre for the small outlay for the irrigating plant.

SPREADING LIKE WILDFIRE.

When asked for his opinion as to the future of irrigation, Superintendent Gapen said it was bound to become general; that the large number of letters that come to him show that the irrigation movement is spreading in the east like a prairie fire. He believed that "THE IRRIGATION AGE, the pioneer in this new field of an old science, is destined to have a much larger circulation east of the 100th meridian than west of it, as there will be a larger number of farms irrigated east of that line." He added, "I can see no reason why farmers should sit idly by and see their crops ruined by droughts. In this climate I should say that two irrigations during the season would be necessary,



VIEW OF PORTION OF IRRIGATED LAWNS, GARDENS AND ORCHARDS, ILLINOIS EASTERN HOSPITAL.



of course, this would depend on ant of rain. I call my system nental irrigation,' as it is intended ement the rainfall. I don't know, but 'supplemental rain' the situation better, for the irrigaare and the rain is not. Almost ner who possesses a well or spring a small cost, comparatively, insure against a dry season. Water will n hill, and the chief thing to take sideration is to get the water to est point on the land. I estimate e cost of a plant-engine, mains, , etc.—to be about \$15 to \$20 per gated. This is the first year's exe. After that the expense would be fuel and labor. I believe the incrops the first season would more ay the entire cost of the plant. be possible in some cases to use s for pumping, but small steam or es are not expensive. In the case ylum, we have a pumping capacity 6,000,000 gallons of water per he institution, so we did not find ary to put in additional engines. ual maintenance of an irrigation nilarly situated to ours, including used to run the engine, and an for the same, would not cost more

per acre. "
apperintendent believes that the invakened in Illinois in regard to this, on account of the severe during the past few years and ess met with on the asylum farm, rigation is demonstrated to be a coess, will lead to an immediate

great advance in this line of work, and that within a few years every farmer will have an irrigation system, or will irrigate his orchards and gardens from wells. In many places a few farmers can join together and take water out of a stream, as was formerly done in Utah and other sections of the arid region.

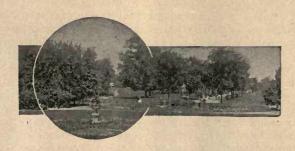
CHEAPER PUMPS—INCREASED VALUE OF FARM LANDS.

The superintendent predicts such a demand for cheap pumping plants, able to deliver water at a relatively small cost, that it will lead some inventive genius to make a pump at far less cost than anything on the market at the present time. He would not advise any farmer, however, to wait for cheaper machinery, as the value of one crop, lost for the want of irrigation, will more than pay the cost of pumps and windmills at the price they are now sold.

N Can

Asked what would be a fair statement of the increase in the value of farm land on account of the irrigation system, Superintendent Gapen replied that the increase in products is four fold, and, estimating on this basis, land which was valued at \$100 an acre without irrigation would be worth \$500 an acre with it.

That the people of the State of Illinois will feel proud of the sagacity and enterprise of the superintendent and board of trustees at Kankakee goes without the saying. They have set an example which will be followed. Illinois leads the way. The farmers of the whole country will fall into line.



WATER SUPPLIES FOR IRRIGATION.*

BY F. C. FINKLE, C. E.

THE first duty of an irrigation engineer who is intrusted with the work of designing an irrigation system for a tract of land requiring irrigation is the examination of the proposed water supply, if one has already been proposed, or an examination for the purpose of finding an adequate and reliable water supply, if this point still remains unsettled at the time of

his taking charge.

The choosing of a water supply for an irrigation system is a matter which requires the greatest skill and care, as upon it depends the success or failure of a system, no matter how well and carefully all other things may be provided for in the construction of the plant. Mistakes in the location of waterways and conduits and errors in designing structures, while they are sometimes serious on account of the expense necessarily incurred in correcting them, are not per se a complete cause for the absolute failure of an irrigation system in which they occur. But a real mistake in the choice of a supply of water for a system is invariably a sufficient cause for the total failure of the enterprise. are of course exceptions to this rule in a few cases, where, in the event of the failure partially or totally of the water supply already planned, another supply can be obtained by adding to and extending the works already constructed. But these exceptions are so rare that a mistake in the choice of a water supply can be said to be fatal to the success of an irrigation enterprise, and the greatest care should always be exercised by the person having these things in charge to avoid anything in the line of a water supply that partakes of the doubtful.

The total quantity of water required is the first thing to be accurately determined. As the amount of water to be carried determines the size and character of the conduits and other necessary works, it is the first thing we must have finally settled before beginning the preparation of plans and specifications or the preliminaries of construction.

The amount of water needed at the head
*All rights reserved by the author.

of the canal or other conduit is really the point to be kept in sight, as there is generally a considerable loss in carrying the water. After the quantity of water required to be delivered at the land to be irrigated has been settled it is necessary to determine how much will be the loss in transmission from the point where the water is taken into the conduit to the point where it is to be applied to the land. A survey of the line—a preliminary or reconnoissance survey is usually sufficientshould be made to determine as nearly as possible the character of conduit to be adopted. When this has been done the loss of water by percolation, evaporation or from other causes can be determined and added to the supply which it has been decided it will be sufficient to deliver for the proper irrigation of the lands to be served by the proposed system.

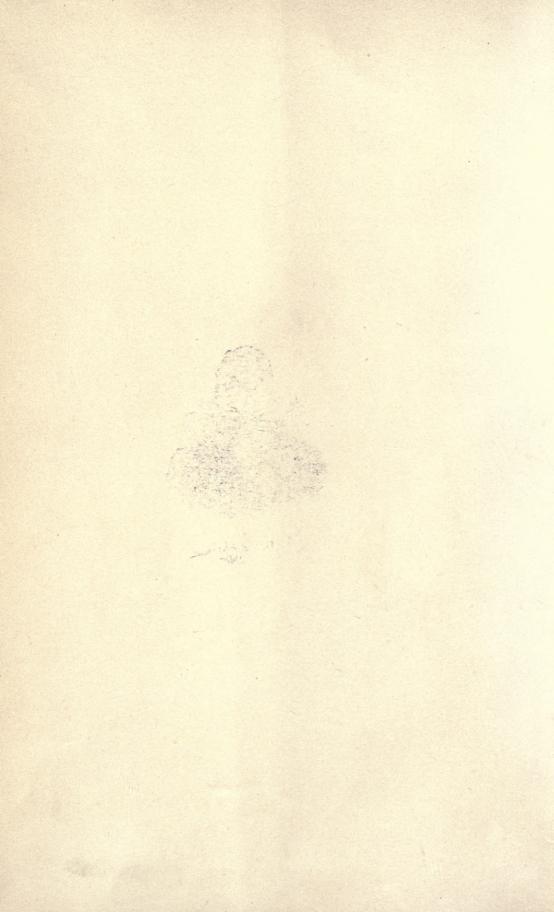
The amount of water required for an acre or other unit of land measure is called the duty of water. The duty of water necessary for the tract to be irrigated must be carefully determined before the needed amount can be stated, and this should be done before the loss in transmission is calculated. The duty of water is in itself a very comprehensive subject and, as such, will be discussed in a succeeding chapter especially devoted to that subject, and the rules governing the loss of water in transmission will also be carefully discussed hereafter in the chapters dealing with the different kinds of conduits.

Another question the solution of which requires careful study is the season of the year at which irrigation is necessary. The problem of a water supply must be carefully studied in connection with this question.

The irrigation season in different localities varies as to the time of the year at which it occurs. As a general proposition it may be stated that the irrigation season occurs when crops are growing and maturing, but this does not fix any definite time for all localities, as the crop season follows the climate and occurs in different latitudes and longitudes at varying times of the year. The location of a region with



lelake Gapen



reference to bodies of water, mountain ranges, etc., also has a marked effect upon climate and consequently affects the crop season and time for irrigating to quite a considerable degree. Again a portion of the season at which crops are growing may be abundantly supplied with moisture by nature, while the portion which is deficient in natural humidity may require more or less irrigation. It therefore becomes a matter of the highest importance to study conditions and definitely fix the time of the irrigation season in a locality for which a supply of water is being sought. If this is done much time and labor will be saved in analyzing and studying the water question, as the investigations can be confined to a stated period of the year, and ignored as to the time when we are aware that no water will be required.

LENGTH OF IRRIGATION SEASON.

While the time of the irrigation season varies in different localities, the duration of the period in each year when irrigation is necessary varies even more. In cool climates crops grow and mature very slowly, while in warm regions their progress is more rapid. As a perfectly natural consequence to this the irrigation season in one place may be of double the length that it is in another. Some crops require a longer period for their growth than others even in the same locality, and frequently two crops of different kinds are taken from the same land; especially is this latter statement true in relation to lands lying in the tropical and semi-tropical zones.

All such matters will have to be carefully studied and determined in reference to any particular locality, before the extent of the water supply needed can be

fully ascertained.

In such investigations, the doubt, if any there be, should be given to make the water supply safe and ample, so that no error is committed for want of conservative judgment and action. If different crops can be grown the amount of water should be figured for that particular kind of crop which requires the most water and consumes the longest time for its growth; and if two crops can be raised on the same land each season, enough water should be provided so that this can be done if desired. Every precaution should be taken to make the water supply ample for all required purposes and possible future de-

mands upon it, to the end that the lands watered will be able to support the largest possible population and yield the greatest

production.

As will be seen later on, the length of the irrigation season does not affect some classes of water supplies, such as running streams, where it is only necessary to determine the minimum flow of the stream during the period covered by the irrigation season. But on the other hand it is a most important consideration in some cases as for instance in the case of storage reservoirs, in which the water is collected during one part of the year, when no irrigation is required, and expended during another part of the year, i.e. during the irrigation season.

The physical conditions affecting the question of the selection of a water supply are many, and can only be determined by careful observations and accurate surveys. They are not the same for all sources of water supply and can therefore be best discussed hereafter in connection with the separate discussion of each mode of water supply known for irrigation pur-

poses.

CLASSIFICATION OF IRRIGATION WATER SUPPLIES.

The different classes of water supplies for irrigation purposes may be grouped in two main divisions: (1) Gravity Supplies;

(2) Pumping Plants.

A gravity supply is any water supply, which has sufficient head or elevation to enable the water to flow and be discharged upon the land where it is to be used for irrigation without the application of power for raising it above its level at the point of diversion. A pumping plant for irrigation is used only where the land to be watered lies at such an elevation that the supply of water proposed for its irrigation can not reach it without being raised by means of power.

Gravity supplies for irrigation come from a number of different sources, the principal of which are: (1) Flow of natural streams. (2) Underflow of rivers or creeks. (3) Storage reservoirs. (4) Springs and swamp lands. (5) Artesian

wells.

Pumping plants may be erected to pump water from any of the above sources, when the water from them is to be used on lands which are higher than can be reached by gravity flow unaided; but this is seldom done, as water supplies of the above character are generally valuable on

lands lying below their level.

Pumping plants for irrigation purposes are profitably employed in raising water from wells only, and in other cases are very rare and exceptional, being used only where a small quantity of water is required for land above a regular gravity system, or where hydraulic power is available as a motive power.

RELATIVE VALUE OF DIFFERENT GRAVITY SYSTEMS OF WATER SUPPLY.

No inflexible statement can be made saying that any one of the sources of gravity supply named above is the best, nor is it possible to arrange them in the order in which they are to be preferred without the addition of some qualifying expression. It may be said, however, that where a supply can be obtained by simply diverting the water from a running stream, which contains a sufficient supply of unappropriated water, this is the wisest thing to be done rather than to search for a source of supply, which will require considerable money for its development. Still this phase of the question is of importance to the original projectors of an enterprise only, as it does not signify that the water is any better or more valuable to the irrigators, who will subsequently own and use it, than if it had been originally obtained from a more costly source. The value of a water right depends upon its infallibility quite as much or more than upon its cheapness in first cost, and it is better to have water from an undisputed and unfailing source, which it has cost considerable to develop, than to overappropriate natural streams and fall heir to the subsequent evils of litigations and partial failure of the supply.

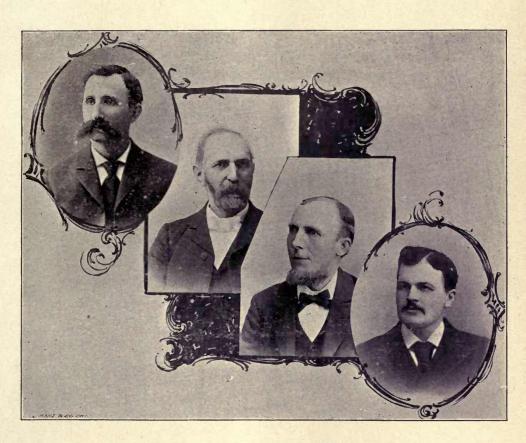
From what has already been adduced in the preceding paragraph we can readily conclude that the flow of a natural stream is a very desirable source of water supply for a system of irrigation works. This is certainly true beyond any question or doubt, providing always that the flow of the stream, where the same is to be diverted, is ample to give the required amount of water. After having investigated and finally settled upon the amount of water requisite to make a projected system adequate for the area to be irrigated,

it therefore becomes equally necessary to study the stream and determine with the same degree of thoroughness what its flow has been for a number of years past and what we may safely conclude will be its discharge in the future. In order to do so a familiarity with streams and the laws governing them in general must be one of the accomplishments of the irrigation engineer, and in the succeeding paragraphs we will therefore briefly discuss the natural philosophy of flowing streams.

THE ORIGIN OF STREAMS.

Certain conditions of physical geography are necessary to the existence of flowing streams of water in a country. land must consist of mountains, hills, valleys, plains, etc, combined in such a manner as to cause differences in elevation and inclination to the surface. The extent of any region having a range of elevations from the highest mountain to the lowest plain or valley, all falling in the same direction or in different directions, which ultimately unite into one valley or basin, is one of the most important conditions determining the length and size of streams. Other important conditions are of a meteorological nature and relate to the evaporation and condensation of water and the movement and temperature of atmospheric currents. Water readily changes from its liquid to its vapory or gaseous state through subjection to heat. Heat applied to a drop of water whether it is exposed to the rays of the sun or to an artificial heat soon causes it to disappear into the surrounding air. This is due to the expansion of the liquid and its consequent conversion into a vapory substance lighter than air, which readily mingles with the atmosphere, being controlled and moved by it, until by condensation it again becomes heavier than the air and descends to the earth. The heat of the sun is constantly exerted to expand water exposed to its rays, and its power causes evaporation from the surfaces of bodies of water and from the water contained in organic and inorganic substances in the form of moisture.

The vapors thus formed fill the atmosphere and move with the prevailing winds until they reach higher altitudes, where the colder air condenses them, or until a cold current of air meets a warmer one, which is heavily laden with vapor, and



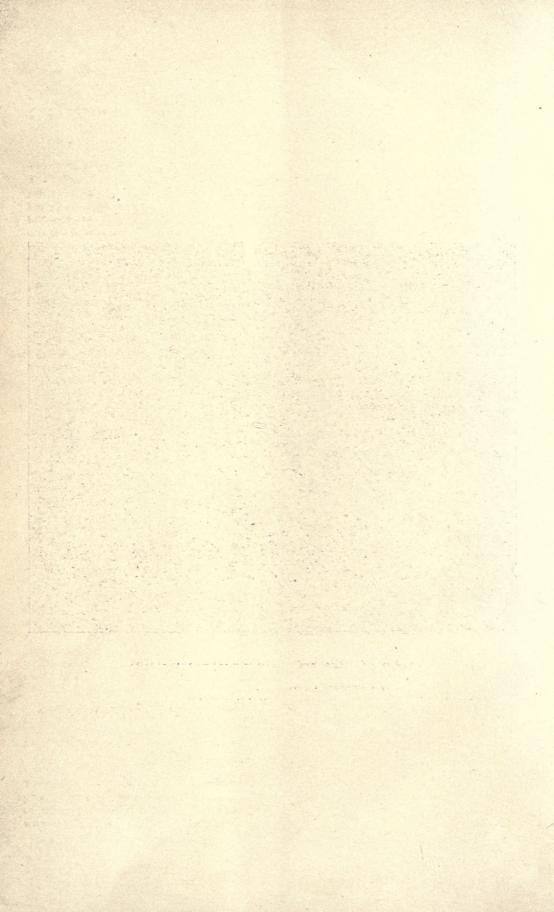
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A. L. GRANGER, SECTY AND TREAS.



causes the condensation and subsequent reappearance of the evaporated water in the form of rain or snow.

We now have all the conditions necessary to the creation of a flowing stream of water. As soon as the ability of the soil to absorb the rain or melted snow is exhausted, it begins to flow along the inclined surface, always seeking its lowest level, until the union of one small stream with another in a common channel produces a creek or river of importance.

ABOUT RAINFALL IN GENERAL.

Owing to the irregularity and unevenness of the surface of the earth, causing differences in the area and elevations of watersheds, and variations in the temperature of the atmosphere together with the varying distances between bodies of water, the length, size and the volume of flow of streams at different seasons of the year is a matter of much uncertainty. It depends upon the amount of rainfall on the area tributary to the stream and its distribution throughout the year either by the constant recurrence of rains or the melting of accumulated snows. In the case of large rivers, where the volume of flow is derived from a large watershed having a copious rainfall, the supply is probably so much greater than all possible demands, that investigations of the rainfall are unnecessary. But such rivers do not frequently exist in arid regions, and the irrigation engineer is generally called upon to obtain a supply from streams having a limited as well as a poorly and unevenly watered drainage basin.

In such cases it is necessary to proceed with the utmost caution, and to carefully investigate the amount and distribution of the rainfall throughout a sufficient number of years to determine the available supply of the stream.

VALUE OF STATISTICS.

All civilized countries have statistics of the rainfall on its principal river basins and watersheds and of the flow of its principal streams at different seasons of the year. The value of these statistics, of course, depends largely upon the efficiency of the service under which they are prepared, but it is safe to recommend the reports of the signal service and meteorological departments and the reports of the geological survey of most countries, as a source from which a large amount of reliable information can be drawn regarding the capacity and discharge of the principal streams of those countries.

Statistics prepared by private individuals and corporations, who are or have been the projectors and owners of water works or irrigation enterprises, may be said to be equally as valuable if not more so than those prepared under government supervision, and when they are obtainable much valuable information can be obtained from them. But as a rule these only relate to watersheds or streams which have already been improved or appropriated, and are useful only in making examinations and reports on existing works, or for drawing conclusions and making estimates on works projected in the immediate vicinity. No tables of statistics relating to rainfall or the areas of drainage basins of streams will be reproduced in this work, as this would simply be copying public records, which are open to all, and would occupy space which is more valuable for the discussion of principles.





THE ART OF IRRIGATION.

CHAPTER VIII. CHOICE OF METHODS (CONTINUED). PREP-ARATION OF THE GROUND.

BY T. S. VAN DYKE.

OTE-[As the publication of this series has been suspended some fifteen months the reader may have to go back over some of the ground passed over before fully understanding this. The first seven chapters were mainly introductory, dealing with the errors of the early irrigators to a large extent because experience has shown that almost every one if left to himself will follow exactly in their footsteps. The study of error is as valuable as the study of going right, and every one should read the history I there gave. Those chapters contained also a large amount of facts necessary to a full comprehension of what is to follow and too numerous to repeat. Those who have not read them must therefore attend more closely to what follows, for it will be the more practical part, or how to do it as distinguished from how you don't do it.]

Next to the quantity of water at your service, the size of the irrigating head in which you can have it, and the length of time you can allow it to run, the slope of the ground becomes the most important factor in determining the method of applying water. If the slope is great you can not flood by checks of any reasonable size. If they are very small their number becomes a nuisance in making and in handling the water from one to the other. not small then the water stands too deep and too long in the lower part; and too much puddling, with compression of the soil, is the consequence, besides uneven All these are to be carefully avoided where possible. The slope may be so great as to compel you to terrace if the nature of the product will justify the expense. If the soil is easily worked it may pay to terrace some on a very light slope, making the terraces very broad. may pay even for alfalfa. If terracing will not pay you may then be driven to the use of basins or rings around the tree or vine where the slope is great. On such ground you can do little with large heads of water for a short run but must in some way work with small streams with a long

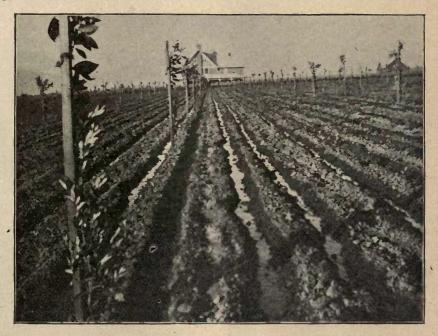
And as a rule it will rarely pay to bother with anything but trees, vines or vegetables on ground having very much slope. Alfalfa and grain can be grown on it but they will not generally pay except

for home use on a small scale.

Good drainage in irrigation is almost as essential as water. Where the drainage is bad you must avoid flooding if possible and use small streams or you may have a sour, cold soil, with alkali perhaps appearing on the surface when it dries and becoming constantly worse. On the other hand, if the ground contains alkali, which rises to the surface in quantity sufficient to be injurious, flooding is often the only way it can be removed. If there is sufficient slope to carry water rapidly off, ground that has become badly alkalied may be put in good condition by a quick flooding that will dissolve all the alkali on the surface and then letting it run off as fast as possible. if very liable to alkali it should be laid out so that it can be flooded in this way if nec-But drainage must still be provided if possible. You must remember always that in irrigation, however slowly or carefully done, if done on a scale large enough for a commercial success, a much greater quantity of water is put upon the ground in a given time than is usually done by the clouds even when unusually generous. And in the course of the year one who has any kind of a respectable water supply will generally put more into the ground and have more run off of it than will be the case from rain in the wettest parts of the country. Therefore there must be provision for the water to run away beneath if possible, or, if the soil is not naturally well drained, care must be used in putting water into it so that there be no excess. Waste water ditches above ground must be provided for what runs away and all rights of way should include these for individuals as well as companies.

There is a distinction between "alkali land" and land liable to alkali that should be kept in mind, though the difference is none too easy to define clearly. Almost any land forms some alkali in every country, and under bad drainage may show too much when irrigated. The spots of natural alkali seen on the surface of the ground in some of the deserts are instances of this. They are not found where the soil is perfectly open below with good water beneath. There is somewhere a subsoil of some tight material that stops the alkali as it is carried down by the water from some occasional cloudburst or unusual rain. Then the evaporation brings it again to the surface where it is left as a white powder. Alkali is not often in the

Oranges do not seem injured by considerable of it, though ground so badly drained as to make alkali possible will not generally produce a fine orange. But the possibility of alkali is always to be considered in irrigation; for under ordinary treatment it grows worse instead of better. Thousands of acres in California that were once fertile land, showing no trace of alkali on the surface, but having it in the subsoil, have had it brought to the surface by bad irrigation and defective cultivation and drainage and are now about worthless though they may be reclaimed. But ground with an open soil and good sheet



SPECIMEN OF VERY GOOD FURROW IRRIGATION. A YOUNG ORCHARD WITH GROUND BETWEEN ROWS OF TREES.PLANTED WITH VEGETABLES.

sheet water below but is more commonly in subsoil of some tight material from which it is carried up and down alternately by capillary attraction and leaching.

"Alkali land," as it is called, is land already so full of alkali as to show plainly either in efflorescence or coloring standing water on the surface. Such land is not necessarily bad. If the alkali is not too strong on the surface the soil will raise many things as well as any land. When once well started alfalfa will stand considerable of it. So will corn and many kinds of vegetables, especially beets. So will many kinds of fruits, especially pears.

water beneath, and hardpan lands with a slope of fifty feet or more to the mile have been worked for years with the worst kind of irrigation without showing a trace of alkali.

Your choice of methods will also depend upon your object in irrigating. Almost every rule and caution that this work contains may in some places and for some purposes be disregarded. Are you irrigating for profit or only to raise something for your own use? If for profit it may pay you to do the best work possible. For remember that good irrigation is often as far superior in results to bad irrigation as

bad irrigation is to no irrigation. But not always. If the best work costs too much and the market is unsteady there may be too much risk in this. You may be able to do one kind of work yourself but with another may have to hire help or buy material. And if you are working the ground merely for your own convenience and care little for looks bad work may be good Suppose you have a bed of onions for your own use. If any way of injuring them materially by bad wetting can be devised I have not yet been able to discover it. By good work you might get a better crop and if you were raising them to sell it would doubtless pay you to do better work. But you can not much affect the quality of the onion by any style of applying water and with any reasonable amount of it you will have from a small piece of ground more onions than you can use. Out of pure curiosity I have made desperate efforts to damage the radish with bad irrigation; but as long as it gets enough water the quality is hard to injure and the yield from a small bit of ground will be large enough, if the weather is right. It is much the same with beets, cabbage, carrots and all tough vegetables. But if you are raising stuff to sell and have a sure market the very best work will generally pay and for all high grade products is quite certain to.

The rainfall and its distribution as well as the kind of weather that generally follows rain will also have an important influence upon your choice of a system. In much of Southern California, the ground holds moisture well and the rainfall averages about eighteen inches with a minimum of about seven happening only at very long intervals. Good crops of grain on a rainfall of only twelve inches, some of which by coming too early is practically lost, are a common sight in short years. And with good summer following fair crops are raised on the very minimum of seven inches. Thirty bushels of corn on upland on which not a drop of rain has fallen since the seed was planted are common on well plowed and cultivated uplands in average seasons without a particle of irrigation. And where the ground is well cultivated good yields of fruit are common even in the average years if the trees are not too old or too heavily loaded. dry period is generally more than six months but with good cultivation the moisture retained in the ground from the winter rains carries most things through quite well. I am fully aware of how monstrous these statements will appear to many, but the truth can be had from hundreds of places, and not for one year, but for over a dozen.

Under such conditions vegetation may need but a little drinking water and any way of supplying it may be good enough for the purpose in hand. The soil may be nearly moist enough to enable the roots to feed and may need but a trifle more. Such is the case in the greater part of the States east of the Mississippi where irrigation will certainly be used before many years to carry many products over the periods when the rainfall is too short and where it would pay them to do it now if they only knew it. But it would be folly to put in the expensive systems necessary in those sections where the rainfall is of little or no use, and where the air is so much hotter and drier that vegetation demands water to evaporate through the And it might be equally unwise to do the fine work that for high grade products pays so well in California. only trouble is that from fair results from careless work too many conclude that it is good enough anywhere.

GRADE THE LAND.

In whatever way you apply the water it will pay you to have the land so graded to a uniform slope that the water will run in all directions at about the same velocity. This will be true if you are to run it only from one small basin to another, still truer if you are to run it in large heads from check to check, and still more important if you are to run it in a large number of small streams across the tract. You will get back all it costs in time and patience to say nothing of the greater uniformity of the wetting, and the greater ease of cultivation and consequent better results. It is almost impossible to make people realize this until there has been considerable loss, and often not until the place is planted in an orchard that is paying just a little too well to take out, where the trees are too old to allow good grading between, and yet in yield are steadily falling behind a well-graded orchard beside it. No matter how even or level land may appear it is almost never even enough to irrigate. The result is a swamp here and a dry ridge or hump there. When the swamp is dry enough to cultivate the other is too dry. Uniform moisture throughout the whole is impossible while the work of handling the water and the cultivator afterward is often doubled.

This grading is not nearly so expensive as one would suppose from looking at the places of those who have plenty of money and want everything symmetrical. The ground does not need leveling or anything near it. It is not of the slightest consewhether the water is to run straight across a field or slanting. Nor, aside from looks, is it necessary that the slanting course should be the diagonal of the field. Nor need the furrows be straight or trees or vines planted on perfectly straight lines. Nor need the whole place be graded to the same plane. may have two or more slopes even on a And no inconvenience five-acre tract. from having too many faces could equal the inconvenience of leaving the ground in its natural condition. In whatever direction the water is to run it should run at about the same speed whether it is to be in small streams or big ones. And if the water is to stand on the ground, as in flooding, the depth should be as nearly uniform as is reasonably possible. These are cardinal principles and the man who neglects them will regret it, perhaps when too late.

This grading can be cheaply done if the ground is in the right condition of moisture from rain, properly plowed and a good machine used. It can be made very expensive by ignoring these conditions. It can not be well done with small scrapers that bounce. A road grader does very well and some scrapers are made purposely for this work. But for a few dollars one can make one that will do as well as anything if heavy enough and enough horses put to it. Two long heavy beams, the longer and heavier the better, should be well bolted into an A shaped scraper: An iron shoe along each lower edge should be attached and made so as to cut. The lugs to which the drag chain is to be fastened should be several in number and running down each side of the apex, so that in a moment either edge may be set at any angle to the course of the team. This will smooth down almost any ground

that has been well plowed, and, cut down considerable that has not been. weighted with sand bags and drawn by several horses it will cut wet ground quite well without plowing. If long enough, heavy enough and used long enough it is certain to put an even slope on almost any soil sufficiently open to be well drained. Where there are ravines to fill or boulders to remove the expense is of course increased and one must then begin to inquire whether the value of the product is great enough to justify the use of that piece of land. But do not solve the question the other way, as many do,-decide they will use that land but that the cost of grading is too great to put it in proper shape. As a rule if it costs much to grade that proves it is worth little without the grading. In such cases get another piece. Some of the best orchards in California cost one hundred dollars an acre for the grading alone. Some now bearing the heaviest crops of the finest oranges and lemons look smooth as silk on the surface, yet two feet below big boulders are so thick that you could not take out a cubic yard of them and repack them as closely as they are there in place. ten feet deep in places have been filled with the loose rock from the surface and covered over with dirt. Warmth and perfect drainage make this ground valuable for high grade fruits, fertility being of trifling importance beside these conditions, though even this ground is much more fertile than one would suppose. But for every dollar the owner laid out on this ground he will get back five or ten. have attempted to irrigate it in its natural state would have been almost madness. The same principles apply, however, to ground that looks all right and needs but little work. The difference is only in degree, and if but little work is needed it is all the more reason it should If much is needed it only be done. proves that the land is almost worthless without it and if the crops won't justify the expense you should get a piece where they will.

You must not be led astray by talk about different systems of irrigation. Nothing is more absurd than to hear some one talking about "the diagonal system" for instance because the furrows are run diagonally across the field, or flooding

called a "border system" or a "plat system" because the checks are made small, or something called "subirrigation" because the water soaks upward from underneath, either from general soaking of the subsoil from big ditches on porous soil, or from the upward seepage from small furrows made very deep so that the plant stands on a high ridge between them. .All this multiplication of nonsensical distinctions is confusing. Great numbers of such distinctions have been made and most of them are as valuable as the old distinction between tweedle dum and tweedle dee. When familiar with the principles on which the value of all of them depends you will see that systems are very few in number and very simple. And even then you will find that some are used, not because they are the best, but because the cheapest. Alfalfa for instance can be raised as well, and on some soils better, by watering from many small furrows. There is no better alfalfa in the world than that raised in this way. the water supply allows you to flood it will generally allow you to irrigate in this way. If you are raising only an acre or so for home use, for a milch cow and a few chickens, etc., it will probably be cheaper and easier to use the small furrows, as is done on thousands of small patches in Southern California. But if you are raising large crops in large fields, then the economy is generally the other way, and where the land is very flat it becomes by far the cheaper method.

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THE CODY CANAL IN WYOMING.

BY ELWOOD MEAD.

AT the eastern base of the Shoshone mountains, where the river of that name emerges from the shadows of its-canons to cross the plains of the Big Horn Basin, is a series of terraces left by the receding waters of some prehistoric lake.

These lie one below the other along this stream for forty miles, extending back from it two to ten miles. So uniform is the contour of these successive steps that in many places water will follow a surface furrow along section lines across an entire township. The abundant water supply of the river, the fertility of the soil, and the ease with which water can be distributed, give these slopes a peculiar fascination to the practical irrigator.

Ever since the advent of the first emigrant this tract of land has been a source of longing to the homeseeker. As the possibilities of this region became better understood its attractions have increased until it has become generally known and regarded as the most extensive and desirable body of irrigable land in the state.

At present the entire tract is arid and unoccupied. Even the speculative land grabber, masquerading as a homesteader, has not found it worth his attention. The prospect of diverting the river which flows through it has seemed so remote and the obstacles so formidable that it has been

considered a project for the next century rather than the present. The Shoshone river from where it leaves the mountains until it passes the lowest terrace is hid below the nearly vertical rock walls of a canon almost as deep as it is wide.

To surmount these rocky slopes with a canal is out of the question. To reach these lands in any manner is equally beyond the reach of the individual settler. Nothing but aggregated capital and the best engineering skill will answer. Neither of these were available under the public land laws which make canal building a lottery in which the builders buy the tickets and the settlers, on the land reclaimed, draw the prizes; but with the passage of the state law accepting supervision of one million acres of land for reclamation the opportunity was open to invite the joint efforts of the capitalist and colonist to effect its transformation.

This law came at an opportune season. Increasing settlement has demonstrated the wonderful fertility of this soil and has shown that the shelter afforded by the snow-clad mountains which surround the Big Horn basin gives to this region a local climate, milder and more uniform than is enjoyed by any of the surrounding country. The curative virtues of the medicinal springs which gave this river its

original name are becoming widely and favorably known; four thousand acres north of the river have been located as gold placers which can only be washed by a canal high enough to irrigate the entire tract.

The region surrounding the headwaters of the Shoshone river is one of the greatest game preserves in the Rocky mountains, and is destined to be one of the Nation's pleasure grounds in the near future. unique grandeur of the scenery of the Hoodoo or Goblin mountains will become more and more attractive as new trails are opened into their hitherto inaccessible heights. One serious drawback has been its isolation. Fifty miles to the nearest railway station is farther than the average pioneer desires to go. Red Lodge is about that distance from the center of these This objection promises to be removed at an early date; the transcontinental survey of the Burlington railway passes up the Shoshone river and the last extension to Billings, Montana, leaves it only ninety miles away.

THE PROPOSED CANAL.

These considerations have drawn the attention of the outside world, have led to three separate surveys to discover a feasible canal line, and have finally resulted in a location which while covering nearly three-fourths of the entire tract is secure and not exceptionally expensive.

The river canon is avoided by beginning the canal above Cedar mountain, the last range cut through by the river. canal emerges from the mountains through a low pass several miles south of the river and about five hundred feet above it. This is accomplished with but little heavy work. The terraced formation extends above this mountain and the lake deposit has covered the underlying rock to a depth which affords easy ground for the required excavation. Actual construction began in September, and at last accounts about three miles had been completed, it being the intention to construct seven miles before January 1, 1896. The permit from the State Engineer's office is for a canal sixty-five feet wide and six feet deep, with a grade of two feet per mile. The portion completed is only excavated one-half this width, it being the intention to enlarge as increasing use makes necessary. In this way a large part of the construction work will be reserved for the settlers who will be given preference in letting contracts therefor.

In many of its features this canal is destined to occupy a unique place among our great irrigation works. With most canals, the problem is to secure elevation, with this it is to dispose of it. The headgate is five thousand, seven hundred feet above sea level. In fifty miles the canal falls twelve hundred feet and the lower end is little if any above four thousand feet above the sea.

This excessive slope requires a series of drops. The first occurs at the pass south of Cedar mountain. Here is a vertical fall of two hundred and fifty feet, the water tumbling down a rocky slope. Nearly all the drops are arranged to occur at the passage from one terrace to the next below. In this way the expense is greatly lessened. Two of these will require the construction of chutes to confine the water in its descent and protect the canal from its erosive action; but in two others the water will find its own channel down rocky slopes, the material being hard enough to resist its erosive action. One drop occurs at the head of the ravine in which the placer deposits are found and a head of two hundred feet can be had for hydraulic mining. The first descent will doubtless soon be used for the generation of electricity for both lighting and power, as it is near the Shoshone Hot Springs and the proposed town of that name. Doubtless the entire available water power will in time be utilized.

While the headgate is on the south side of the stream about ninety thousand acres of land to be reclaimed are on the north. To reach this will require either a flume one hundred and twenty feet high, or a pipe passing down one side of the canon and up the other. The canon at the point selected for the crossing is about one hundred and fifty feet wide on the bottom and three hundred and fifty feet at the level of the proposed flume.

Between one hundred and twenty-five and one hundred and fifty thousand acres of irrigable land can be watered from this canal. If settled in small tracts it will support twice the present population of the entire State. If half is placed under cultivation it will be six times the cultivated area of the entire State in 1890.

Such a work has more than local interest. It is not only the most important irrigation work yet seriously considered in the State, but its magnitude as compared to what has heretofore been accomplished is so great as to overshadow all past efforts, and its success is destined to exercise a decisive influence on the future of the State.

In the face of the increase in population and material wealth which must accrue, the malignant and demagogical opposition to agricultural development, which has beset this enterprise and which has been so conspicuous a feature of this State's history, must cease. The effort to keep this State as an open range, to array selfish interests against the State's growth, to arouse prejudice against canal companies by demagogical appeals, has succeeded in placing Wyoming behind every surrounding State in population and material The inauguration of this prosperity. project under these adverse conditions means a different and more enlightened appreciation of our opportunities.

This project is conceived on a broad scale. A mammoth canal; an extensive area to be reclaimed; immense possibilities for material development in the generation of cheap power for mechanical purposes; the creation of important towns in what is now an unbroken solitude, and the transformation of the conditions of one of the most favored sections of the State are attractive material results, but they are equaled by the generous purpose which inaugurated this enterprise and which animates its president and leading

spirit.

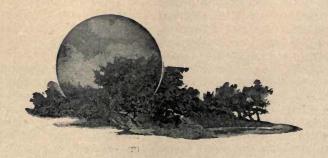
BUFFALO BILL'S ENTERPRISE.

"I propose to leave a monument of my work for the West by founding a colony

in the Big Horn basin which shall be to Wyoming what the Greeley Colony is to Colorado."

This statement of Col. W. F. Cody (Buffalo Bill) explains the origin and underlying purpose of the Cody Canal. While the work is intended to be a financial success, and will be managed to that end, philanthropy is to share with profit in all its transactions. It is not to be a canal to acquire title to land. The land goes only to actual settlers in tracts not to exceed one hundred and sixty acres to each settler. It is not intended to speculate on the rise in land values. Each settler pays fifty cents an acre, no more, no less. Twenty-five cents on making entry and twenty-five cents when proof is made of reclamation. It is not a canal to derive a perpetual or exorbitant income from Each settler under the water rights. canal must purchase an interest therein. Not a vague promise, such as constitutes many instruments known as water rights, but an actual proportionate interest in the work itself. The water rights come from the State, attach to the land reclaimed and are inseparable therefrom. The interests in the canal will be based on the cost of the work. It is simply capital, energy and system combined to construct the works for the settlers, who, when they are paid for, will own and control them.

If the experience of the last quarter of a century is to be a guide this canal is destined to be a success. A success because the physical conditions are favorable and because settlers are here freed from many of the economic mistakes, not to characterize them more harshly, which have marked settlement under earlier attempts at canal building on a large scale.



THE MINERAL WEALTH OF WYOMING.

BY ARTHUR W. PHILLIPS.

IN the limited space of a single article it is not possible to do complete justice to the subject of the mineral resources of the whole State of Wyoming. The storehouse of undeveloped wealth is so vast, the varieties of mineral so many, that the adequate description and handling of this subject would fill a large volume.

The writer does not pretend to be an expert in all the different mineral resources here mentioned, and is solely actuated in the penning of this article by the desire to publish to the investing public a few facts about the extraordinary opportunities for the investment of capital in developing the almost untouched

treasures of Wyoming.

In this State there are mountains of the finest iron ore, vast deposits of coal, soda, gypsum, salt, sulphur, copper, lead, tin, mica and other minerals, also marble, granite, sandstone, mineral paint, fire clay, kaolin, graphite, cinnabar and magnesium. Silver is found in many places and the discoveries of gold are attracting the attention of capitalists at the present time. Very extensive oil basins exist in Central Wyoming and are now in course of development and will no doubt take the lead amongst the valuable resources of the State. For some years past operations in drilling wells have been carried on at Salt Creek in Natrona county under great difficulties, but the success which is now crowning the efforts of the pioneers in this business, is lately stimulating others to follow their example, and several strong companies are now starting in to develop oil lands in Natrona and Converse counties. The oil obtained from wells and from oil sand near the surface in these two counties is truly remarkable, considered from any standpoint. Not even kerosene is found in any appreciable quantity in this oil, to say nothing of the lighter products. The average Pennsylvania oil produces from 40 to 70 per cent kerosene, while the Wyoming oils contain 90 per cent of high grade lubricants. This oil is beyond question the best crude oil for lubricating purposes that has ever been discovered.

The oil produced at Salt Creek is a dark olive-green color, and has been tested in every way, from the farmer who uses it on his mowing machine and his wife who uses it on her sewing machine to the locomotive engineer who puts it in competition with the high grade manufactured lubricating oils of the East. All opinions are the same, as to its being superior in its crude state to the best Eastern lubricating oils, which retail at \$1.00 per gallon and upward.

The present wells are fifty miles from the railroad, and every barrel of oil is hauled by wagon over rough roads at a cost of over \$2.00 per barrel, but even at this rate the business pays well, because

of the superior quality of the oil.

During the past year a refinery has been erected at the railroad at Casper, and every grade of oil is turned out, even to the finest watch and spindle oils, without adding any animal or vegetable oils. The quality of the Wyoming oil is superior to any in the known world, surpassing even the famous Russian or Sumatra oils in body and consistency. It is used as a lubricant for many purposes in its natural crude state, and has no equal for such purposes. Wyoming crude oil sells for \$10.00 per barrel at the railroads in Wyoming, and has never been sold at less than \$8.00 per barrel, and the demand is rapidly increasing.

By refining under distillation, and without adding any animal oils, the finest grades of spindle and watch oils are obtained. These refined oils sell at wholesale for big prices, valve oil bringing \$25.00 per barrel, engine oil \$15.00 and the finer grades even more. Crude oil, just as it is obtained from the ground, sells in

Omaha for \$1.00 per gallon.

When it is considered that these wells average twenty barrels per day, and that the expense of operation of the same is very light, any one can readily figure out that profits must be enormous.

The chemical tests of Wyoming oils show that they are both illuminating and lubricating in character, the latter being the most valuable, and largely predominating, and not found to any extent in any other oil field. The lubricating qualities of the oil found in this State have been tested by the ablest chemists of this country and Europe, and have been by both pronounced the best lubricants yet found in any country. Mr. Taylor, the chemist of the Standard Oil Company, at Cleveland, Ohio, said it was the best natural lubricating oil he had ever seen. Probably there is no scientific expert in any country whose practical experience and thorough knowledge concerning oils is superior to that of Mr. Taylor, long thus connected with the greatest petroleum oil company on the globe.

Messrs. Wyner and Harland, public analysts of London, England, report on Wyoming oils that "when properly treated by distillation the product obtained would form lubricating oils equal, if not superior, to the best vegetable or animal lubricants."

Hutchison, Robert oil refiner Springvale Oil Wells, Glasgow, Scotland, to whom was sent a small sample of surface oil obtained by skimming a spring in a tunnel near Douglas, in Converse Wyoming, reports as follows: "As requested by you, I beg to report as follows respecting the sample of Wyoming oil lately handed me. Owing to want of time I have been unable to examine the above thoroughly, and so can not commit myself positively as to its quality, further than to say that the body is far in excess of any mineral oil I have ever come in contact with, and if the color of this oil comes up well in refining, it will, I believe, be without a competitor in the market.

"Indeed it is so heavy that it appears to me it would require to be thinned down by mixing with lighter oil. would be a great recommendation as to its merits in the eyes of consumers. I find that the color comes up most satisfactorily by treatment with chemicals, but had I had sufficient of it I would prefer to have done it by distillation, as I am convinced that the latter method would be both cheaper and give even better results as to color. After being refined the oil has a body much superior to the best Russian oil. The practical meaning of this is, that it has a greater mercantile value than the latter oil, which sells wholesale in this country at about £23 (\$115.00) per ton, and that, at equal price, once its merits are known, it would get the undoubted preference against the Russian. It is, in my opinion, more than probable, however, that it would be preferred to rape and even become a serious competitor with lard oil for a large variety of purposes, in which case its value would be much greater than what I have mentioned, but, taking it at the most moderate estimate, I think I am within the mark in saying that the Russian Oil, which has been a perfect fortune to the proprietors, would have no chance against it."

The following analysis and letters are in reference to a piece of oil sand rock, 48 lbs. in weight, which was obtained from a tunnel near Douglas, Converse county, about 27 feet from the surface of

the ground.

THE UNIVERSITY OF WYOMING. DEPARTMENT OF CHEMISTRY.

LARAMIE, WYO., May 18, 1895.

A. W. PHILLIPS, DOUGLAS, WYO.

Dear Sir:—Professor Knight and I have distilled the oil from the greater portion of the rock sent, carrying the process to complete exhaustion of volatile products by heating the retort red hot. The rock carries about four retort red hot. The rock carries about four per cent crude oil of high specific gravity which could be used as a lubricant without further treatment. By redistilling the oil we separated it into six portions, of which samples are sent you. The oils are all heavy, and by regulating the process of distillation for that purpose, about 50 to 70 per cent of high grade lubricating oil of a specific gravity above .880 could be obtained. The residuum would also be of

It is quite probable that in lower strata, or in a lower part of the same stratum, the yield of oil will be richer. If we can assist you in any way in the development of this very interesting discovery, please let us know.
Yours truly,
E. E. Slosson,

State Chemist.

Extract from a letter received from the State Chemist, May 23, 1895.

"The oil sand you sent me produces more high grade lubricating oil than any other in the State yet analyzed. The value of lubricating oil increases with the temperature of vaporization and the specific gravity.

"Oil between .860 and .890 are lubricating oils for lighter machinery, .890 to .900 for heavy machinery, and those above .900 are classed as cylinder oils.

"If the distillation had been carried further the residuum would have afforded 10 per cent

the residuum would have afforded 10 per cent to 20 per cent more high grade oils, leaving a residue of coke." The following is the analysis of the oil sand referred to in the foregoing letters:

SCHOOL OF MINES. University of Wyoming. CERTIFICATE OF ANALYSIS.

LARAMIE, WYO., May 18, 1895.

100.0

Temperature No. of of Specific Per Distillate. Distillation. Gravity. Cen	
1. Below 100 C816 10.8	3
2. 170–220 C845 14.5	,
3. 230–270 C892 16.0)
4. 270–290 C910 13.5	}
5. 320 and above .923 10.8	}
6. Residuum 34.0	,
100.0)

E. E. SLOSSON, State Analyst.

The above analysis is of surface oil, the product of the wells at a depth of 800 to 1100 feet showing no residuum worth mentioning, the entire product being com-

posed of valuable oils.

A barrel of Wyoming crude oil, just as it came from the well, was sent to the World's Fair at Chicago where the best chemists in the world tested it fully, and it was placed in competition with all the oil products on earth. After weeks of labor these judges awarded to Central Wyoming lubricating oil the first prize over all competitors.

This field presents the most sure and attractive field for investment of anything in the West. Within the recognized oil belt here, not a single well has been put down to the adequate depth, and properly cased, that is not a producer today.

The average depth of the wells is about 1,000 feet, and their average production twenty barrels each per day. At \$10 per barrel, these wells are certainly very remunerative. The whole Franklin, Pennsylvania, field, the only lubricating oil basin in the East, produces less than 200 barrels per day, and from three to five barrels is the average yield of each well. It is not strange, therefore, that the Eastern oil man is loath to believe that the Wyoming wells are so productive.

The oil belt of Wyoming extends en-

tirely across the State. In the extreme western part of the State there are oil indications, which indicate the presence of what is termed "shale oil," of little or no value.

The next basin is known as the "Duton Basin," where three wells have been drilled, and an abundant supply of oil obtained. This oil is largely composed of tar and asphaltum, and carries a good percentage of illuminating oil. come the Rattlesnake Mountain Upper Powder River basin, in which some years ago a well was begun, but never finished, although some oil was obtained which was lighter than that found further west. In this locality there are many oil springs, and where the oil runs out on the ground it forms beds of asphaltum, some of which was on exhibition at the World's Fair. The next basin is the "Oil Mountain," where some good quality of oil has been obtained. North of this locality about seventy-five miles across the Big Horn mountains lies the No-Wood basin, where the oil is of a superior illuminating character, in fact the settlers of that neighborhood use it to light their houses, in its crude state. A well was started in this field by some persons who had very primitive machinery for drilling, composed of a long beam worked by hand, which is called "Kicking a hole down." Another well has been drilled in the Powder River basin in which was obtained a very superior lubricant. Oil has also been discovered in other places within the State.

Undoubtedly the best portion of the oil fields of Wyoming, however, is confined to the counties of Converse, Natrona and Johnson. The finest grade of lubricating oil is found in these counties, and the excellent railroad facilities make the enterprise of development a feasible business.

proposition.

The Salt Creek wells, which are fifty miles from Casper, will shortly be connected with the railroad by a pipe line, while the oil field of Converse county is traversed by two lines of railroad, the North-Western and the Denver and Gulf railroads, which make a junction at Orin, on the southern edge of the oil basin. Douglas, the county seat, is completely surrounded by oil lands upon which active drilling operations will soon commence. At Salt Creek the principal operators are

The Pennsylvania Oil & Gas Company, The Wyoming Lubricating Oil Company and The French Syndicate. The last named is a new combination which is just starting in, with plenty of capital, which is evidenced by the excellent machinery it has purchased, probably the finest outfit that ever crossed the Missouri.

Near Douglas operations will be carried on by this syndicate early next year, as well as by New York people and a company backed by English capital. That the lubricating oil of Wyoming will be one of the principal resources of wealth to the State in the future is as certain as the fact that there is no oil found elsewhere or manufactured that can begin to compare with it for quality.

To do any justice to the many other resources of Wyoming in this article would be impossible. The coal fields, larger than any in the known world, the splendid soda deposits, the unlimited iron supply, the rich gold fields, both placer and otherwise, each requires treating by itself. Recently near Douglas some rich copper leads have been discovered, which are now being developed, mica and other minerals being found in abundance. Throughout the State there is unusual mining activity, and it will not be long until Wyoming is recognized as the prospector's paradise, and the best place in the world to invest money in mining operations.

A NEW PRINCIPLE RELATIVE TO SUB-TERRANEAN WATERS.

BY CLESSON S. KINNEY.

A new question in the history of water rights was recently decided by the Supreme Court of Utah, in the case of Sullivan vs. Northern Spy Mining Company, 40 Pac. Rep. 709. It was as to whether a person who discovers and appropriates percolating waters on public lands by digging a well to collect the water can acquire an easement and right to take and use the water against one subsequently acquiring the title to the land on which the well was located. The Court held that such a right to the water could be thus acquired. In the dicision the following statutes were construed:

1. The Act of Congress of 1866 (U. S. Rev. Stat. No. 2339) which provides among other things as follows: "Whenever by priority of possession, rights to the use of water for mining, agricultural, manufacturing or other purposes have vested and acknowledged by the local customs, laws and decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same."

2. The Act of Congress of July 9, 1870 (U. S. Rev. Stat. No. 2340) where it is further provided: "All patents granted, or preëmption, or homesteads allowed, shall be subject to any vested and

accrued water right, or rights to ditches and reservoirs used in connection with such water rights as may have been acquired under or recognized by the preceding section." The question that then arose was, is the right to use water under the facts stated, one that is recognized by the local customs and laws? Section 2780, Comp. Laws of Utah provides: "A right to the use of water for any useful purpose, such as domestic purposes, irrigating lands, propelling machinery, washing or sluicing ores and other like purposes, is hereby recognized and acknowledged to have vested and accrued as a primary right to the extent of and reasonable necessity for such use thereof under any of the following circumstances: First, whenever any person or persons shall have taken, diverted and used any of the unappropriated water of any natural stream, water course, lake or spring or other natural source of supply."

The Court in construing these sections said: "We think it would be a very strained construction to hold that a hole dug three feet deep, into which the waters naturally gathered, was not a natural source of supply, while it is conceded if the water came to the surface and flowed along a few feet, and was then collected in a like hole, it would be a natural source of

supply. We are inclined to give these statutes a much broader construction. In our opinion, whenever the industry of the pioneer has appropriated a source of water, either on the surface of or under the public lands, he and his successors acquire an easement and right to take and use such water to the extent indicated by the original appropriation, and that a private owner who subsequently acquires the land takes it burdened with this easement, and we also hold that this easement carries with it such rights of ingress and egress as are necessary to its proper enjoyment."

So far we believe the opinion to be correct and founded upon the great principle of priority of appropriation which underlies the system of water rights in the arid portion of the United States. But, after deciding that a person had a right to appropriate the waters of a well, and also had the right of ingress and egress over the land to and from the well, the Court adds: "This right of appropriation is, of course, subject to the rule of law which will permit the owner to sink an adjoining well on his own premises, although he should thereby dry up that of the first appropriator."

The question of percolating waters is one that is still undetermined in this Western country. The courts have heretofore held that subterranean waters running through a known channel or defined course are subject to appropriation, and that he who is first in time has the superior right to them. But in the above case the course of the waters was unknown and undefined, and the Court held that they were subject to appropriation, but also held that the appropriator's right to them might be lost by the owner of the land simply digging another well by the side of the first, and thereby draining the water from the appropriator's well. It seems to us that the opinion is inconsistent with itself. It is also inconsistent with the great arid region doctrine governing waters in this Western country. Why a person should be permitted to dig another well by the side of that of the first appropriator and drain the water from his well, any more than a person should be permitted to construct a later ditch above that of the first appropriator and divert the waters of a stream to the injury of the first appropriator's rights, we are unable to see. Certainly, waters of a natural stream and subterranean waters, whether flowing in well defined or unknown courses, are both natural sources of supply, and we think that if the principle of priority is to govern one it should certainly govern the other.

THE WRIGHT LAW.

A great deal of interest is being manifested throughout the Western States as to whether the Supreme Court of the United States will decide the Wright Law to be constitutional or otherwise. Not only is this interest manifested in the State of California, from which State the case went to the Supreme Court, but also throughout other States of the West which have adopted laws nearly similar to the one in question, and also in those States where legislation upon water rights is being contemplated.

The law in question has been held to be constitutional by the Supreme Court of California in a number of cases, but by the United States Circuit Court, in which Judge Ross presided, the law was held to be unconstitutional in another case. An effort has been made by which all of these cases, involving the constitutionality of the law, have been consolidated in the Supreme Court of the United States, and will be heard at one time, some time during the first part of the year.

The principal questions in the case are, was the property taken from the private owners by means of assessment and sale of the same with or without "due process of law" and therefore in violation of the fourteenth amendment of the Federal Constitution, and, second, was or was not the property so taken for a public use or purpose? We are of the opinion that the ruling of the Supreme Court of California was correct in the premises. And regarding the second point will say that there is no such thing as drawing a clear and definite line as distinguishing between purposes of a public and those of a private nature. Public and private interests are so commingled in many cases that it is difficult to determine which predominates., But when the Legi-lature has once declared that a certain use is a public one, as it did in the law in question, the courts, as a general rule, will support it when not satisfied that a great wrong has been committed; and, when there is any doubt

as to the purposes, the legislative decision

should always stand.

How the Supreme Court of the United States will decide this question remains to be seen. But taking into consideration the needs and necessities of the arid West, which resulted in change from the common law doctrine of waters to the doctrine of appropriation which has already been sustained by that Court, and also the needs and necessities for the organization of the districts in question for the better development of the country at large, it seems to us that the Court will sustain the decisions already given by the Supreme Court of California.

SUGAR BEETS IN THE PECOS VALLEY.

BY GEO. R. BUCKMAN.

THE sugar beet industry is rapidly growing in importance in the United States, as evidenced by the fact that the production has increased from 300 tons in 1887 to 21,825 tons in 1893. In spite of this great growth, we are still furnishing a relatively small proportion of the world's production of beet sugar, which in the latter year was 3,402,000 tons, about onethird of which was produced in Germany. In Europe there are fourteen hundred and fifty beet sugar factories, while in the United States there are but six. Since the United States produces only about twelve per cent of all the sugar it consumes, it would seem to require no argument to prove that there is room for a further very great expansion of the beet sugar industry in this country. Threefifths of the world's production of sugar is derived from the sugar beet, and hence the facts relating to the progress in the culture of this root in the United States are of natural interest and importance.

It has long been known that the sugar beet attains its highest perfection in the so called arid region of the United States and particularly in its southern portions. The soil and climate of this region, supplemented by irrigation, conspire to produce beets high in sugar and purity and yielding heavily in tonnage per acre. Many well informed people believe that the beet sugar industry of the future will center in this region, and hence are watching developments in this quarter with great interest. I make no apology therefore in giving the following somewhat detailed account of results in sugar beet culture obtained during its present season in the Pecos valley, in southeastern New Mexico, to which the partial failure of this season's beet crop in Nebraska as well as in

parts of France and Germany lends a

further timely interest. It has been known for several years that beets yielding high percentages in sugar and purity could be grown in the Pecos valley; and as long ago as 1891 sample beets from the Valley were sent to the Agricultural Department at Washington, which analyzed remarkably high. But about two years ago The Pecos Company undertook itself by an extended series of experiments to determine accurately the capabilities of this section for beet cul-It engaged for this work Mr. E. M. Skeats, an agricultural chemist of Woolwich, England, who had had wide experience, not only in that country, but in South America and the United States. Under his directions several approved kinds of seed were distributed to the farmers in various portions of the Valley, the growth and cultivation watched, and analyses of the beets made at various stages of their growth. During the present season in particular these experiments have been carried on quite extensively, with results that are astonishing even to those who entertained the highest opinion of the Pecos valley as a sugar beet country. During the early days of November, analyses were made of beets grown in about twenty different places in the Valley. results are remarkable. Beets were analyzed which ran as high as 21.10 per cent in sugar and 86.90 per cent purity, while the average of one entire field was 19.40 per cent sugar and 84.86 per cent purity. These high percentages were found in almost every part of the Valley, the only exceptions being where inferior seed had been used or where proper care and cultivation had been denied. None of the beets examined at that time had

attained full ripeness and hence it was expected that later they would yield even higher results. This has proven to be the case, as will be seen from the annexed table of analyses made about two weeks In this table analyses given of twenty-five beets taken from ten feet of an average row. It will be seen that the average of these beets is 20.87 per cent sugar and 87 per cent purity. One beet yielded 23.75 per cent sugar, which is believed to be the highest saccharine percentage of which there is any authentic record. From the weight of these twenty-five beets it is estimated that the field will yield at the rate of 31 tons per acre.

Analyses	of 25 Beets	Weight.	Sugar.	Purity.
Beets 1 to 7,	each (average	e) 5 oz	. 21.60	88.00
8,	"	9	21.60	87.90
9,	"	8	20.65	85.00
10,		8	19.00	83.00
11,		7	21.10	86.10
12,		8	19.00	83.10
13,		9	23.75	89.00
14,	66	8	23.20	89.80
15,		27	19.00	87.20
16.	"	17	19.40	87.60
17.	"	18	17.90	86.90
18.	"	42	18.60	87.10
19.		14	21.20	87.00
20.	"	14	22.60	87.70
21.		40	19.00	83.60
22.		14	22.10	87.10
23.		22	21.10	86.70
24.		27	20.20	86.00
25		16	21.10	88.40
Average of	10 ft., 25 beets	. 13.8	20.87	87.00

These results are sufficiently astonishing; but this is not all. The climatic conditions of the Pecos valley make it possible so to arrange the times of planting as to insure a continuous harvesting season from September till April. This is of immense importance in the practical manufacture of beet sugar, for the reason that it virtually doubles the average length of the sugar "campaign." This ripening of the beets throughout the entire winter seems almost incredible, but it is an undoubted fact nevertheless, and gives the Pecos valley a very marked advantage over every other region where beets are at present grown. In California the winter rains sometimes spoil the beets by causing a second growth, while in Nebraska and Canada as well as in France and Germany the crops must be taken from the ground before frost. Mr. Alfred Musy, the noted French beet sugar expert, who visited the Pecos valley last April, was astonished at what he there found in relation to sugar beet culture, and with nothing more than this prolongation of the harvesting season. He did not hesitate to pronounce the Pecos valley as by far the most favorable region for sugar beet culture and sugar manufacture of which he had knowledge.

It is almost unnecessary to point out that such a misfortune as has just overtaken the Nebraska beet raisers can not occur in the Pecos valley. In the first place, a summer drought to retard the growth of the beet is there impossible; and in the next place there are no frosts to harm the beet during the last few weeks of its ripening, which is the period when it is adding most rapidly to its saccharine stores.

Possessing these numerous and great advantages, and with the enterprise that has from the beginning characterized its development, the Pecos valley can not fail to become a most important center of the beet sugar industry. The Pecos Company expects very soon to begin the manufacture of beet sugar on an extensive scale, and is maturing plans for the erection in season for next year's crop of a factory with a daily capacity of 500 tons of beets.



IRRIGATION BECOMING GENERAL.

I RRIGATION is spreading throughout the United States like a prairie fire in the United States like a prairie fire in a windstorm. Agricultural classes have been studying the advantages of this sure method of farming for a long time, and the general drought of the past season has once more indicated that the richest and most fertile lands along the largest water courses are not safe without means of watering, for rain cannot be depended upon when most needed. Intelligence is received that for the coming season irrigation will be resorted to in various sections of Illinois, Indiana, Michigan, Pennsylvania, New Jersey, New York, New Hampshire, Massachusetts and Maine. There was irrigation in several of the Southern States in 1895, and in 1896 every State in the whole Southern tier will farm more or less under the infallible It is learned also that sections of Wisconsin, Iowa and Minnesota will fall in line, and that irrigation operations will be largely increased in Nebraska, South Dakota and North Dakota. In the former arid States and Territories of the West, great progress has been made in this safe mode of farming, but this article deals wholly with the rain belt. THE IRRIGATION AGE being the pioneer in irrigation journalism congratulates the country on the general adoption of the methods it has so long advocated.

That the wonderful success of the irrigated farm at Kankakee will give a great impetus to irrigation in Illinois there can Sooner or later this State be no doubt. and other States along the line of the great lakes will be watered by pipe lines from those great bodies of water, Illinois especially, penetrated as it is to be by the great Drainage Canal. Alarmists are saving that the withdrawal of 300,000 cubic feet of water per minute from Lake Michigan by the Drainage Canal will reduce the level of the lakes to such an extent as to interfere with navigation by the largest lake steamers. In a rain of six inches which recently fell over these lakes the quantity of water added to them was 1,079,640,176,000 cubic feet. It would take seven years for the Chicago Drainage Canal to withdraw this quantity of water. This "drainage" canal is really a great ship canal, and by tapping it here and there crops will be aided to make cargoes for these ships.

for those ships.

But that is a matter of the future. For the immediate present, pumping plants convey water from neighboring streams, as at Kankakee, and in this farmers can associate themselves together here and there and divide the expense. Reservoirs and lakes will be made in different sections, and various means will be employed in pumping the water. Two irrigations a season will prove sufficient in Illinois. Gas engines, oil engines and perhaps electricity will furnish the power. and it is likely that wind mills will cut a big figure. With a gasoline engine, a pump and a reservoir, small patches can be independent of any general irrigation companies, though it must be confessed that the latter have proved a great benefit in the far West, reclaiming thousands of acres of barren lands and transforming them into farms that produce not only one, but several crops a season.

During the recent meeting of the Illinois State Horticultural Society at Kankakee, one hundred of the members in attendance, with their wives, visited the irrigated farm of the Illinois Eastern Hospital for the Insane, on the invitation of Dr. Gapen, the superintendent, and the reported wonderful crops of the past season were investigated to their entire satisfaction. That many of these farmers will irrigate their orchards and gardens goes without the saying. Certain it is that a large number of them said they "didn't propose to wait on the rain any more." But corn, and everything that grows, can be irrigated, and. even in the most fertile regions of the rain belt, crops will be fourfold greater with irrigation than without

. 1t.

A bit of intelligence which is of importance to Illinois farm owners can be conveyed herewith. It is that a company has recently been incorporated at Springfield "to buy and sell farm lands in Illinois," which intends nothing less than the buy-

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ing up of farms just now, when farmers, as is supposed, are discouraged and will sell cheap, put in irrigation plants and then sell them off at gilt-edged prices. The headquarters of this company are now in Chicago but the gentlemen have heretofore been operating in the same way further West. The Southern colonies, made up of farmers in Illinois and Indiana, will make their operations very profitable. There is much unfavorble comment in a quiet way, and it is charged that one of the men connected with this company is the prime mover in a certain Southern colony, and that, through other parties, he actually bought, cheaply, the farms of two men whom he personally induced to go South. But the point here is that this company, even in legitimate buying, see a chance for making big money by improving the farms through irrigation and selling them again. If this company can do this, the present owners can do the same, and thus bring up the value of their holdings.

The plan that many farmers will adopt is wind power, pumps and reservoirs or lakes. The bottoms and sides of these artificial lakes only require puddling. After this has been done the seepage will be no greater than the evaporation. A mill that will only pump enough water to irrigate one acre when applied direct from the pump, will irrigate from ten to twenty acres if the water is applied from the outlet in the reservoir. The advantage gained is found in the pushing power of the water when rapidly discharged from the reservoir at a rate of from two to three cubic feet a second, or at the same rate in gallons of from fifteen to twenty-two gallons a second. By this method but little water is lost. The land lying a quarter of a mile from the plant will receive almost as much as the tract directly adjoining the mill. When the reservoir is nearly empty the gate is closed, and it is filled by the same process and repeated on another portion of the farm.

Verily, the age of prayer for rain has been relegated to the dark past.

IRRIGATION PUMPING PLANT IN SOUTHWESTERN KANSAS.

GOLD AND SILVER WEST

NEVER before in the history of the United States has there been such general and widespread interest and excitement in gold discoveries in the West. extends all over the country, and the cablegrams indicate that it is felt all over the world. This furore is created by the new finds in Colorado alone-or the reported new finds in Colorado—and if a one hundredth part of what is claimed for Cripple Creek, West Creek, Leadville, etc., eventually pans out, it is all sufficient to startle the world. But the daily papers of the great Central and Eastern cities are not publishing all the news-or all the reports -from the West. For some reason or other they confine the sensation to Colorado mining stocks. The newspapers of every Western State and Territory are announcing new discoveries. The Nebraska press announces important new finds of gold and silver and, "a rival for Cripple Creek" is claimed for Fremont county, Wyoming. Utah announces a "world's gold wonder in the Mercur mines," on "Herschel" ground; immense shipments of gold are announced from the De Lamar mines in Nevada, gold and opals in Idaho; a big strike of yellow metal in Bill Williams mountains in Arizona; new gold finds in California; a ten-foot solid vein of silver in the Old Dominion mines in Washington; a wonderfully rich gold strike at Monument Rock in the Santa Fé Canvon in New Mexico; a big silver mine in Texas, as well as gold reports from Alaska, and the discovery of an eighty-foot ledge of gold in Vancouver!

There are skeptics, notwithstanding all the excitement, and they are among the politicians and the investors. These people are prospecting about to learn the true inwardness of what they are pleased to term the "boom." The politicians of the gold side look wise, and say "I told you so," while the silver men hint that "all this talk of a flood of gold is part of some scheme to silence the silver clamor throughout the country and in Congress, it being taken for granted that the people, believing the reports in full, will conclude

that with the bringing out of all this gold, the value of gold and silver must become more equalized." They say it seems to them "as if the boom was intended to be wholly gold, and to be for Colorado alone, but the other States and Territories became jealous and 'filed their claims,' the reports of silver from Washington, Nebraska and Texas coming from newspapers which saw through the conspiracy."

Investors say that while they have no inclination at all to deny the truth of the reported discoveries in Colorado, they know that for a year past promoters have been preparing to spring the boom which

has finally come.

The Chicago Stock Exchange has refused to list mining shares, but a Chicago Mining Exchange has been determined upon, with men of capital and reputation as its incorporators. Another institution, perhaps of greater importance, is also to be established, and such men as ex-Governor John M. Palmer suggest and father it. This latter is a rendezvous where miners and others who have valuable claims but possess no capital, may meet capitalists willing to advance funds for the purpose of developing such properties—after an investigation has been made.

Chicago is going into this Western mining development, not only in Colorado but in the other States and Territories, but, so far as the large investors are concerned, they will not go into it blindly. As to the Mining Exchange, the opening of the board is actually dreaded, for it is foreseen that excitement and speculation must run wild. Delegations of ladies and clergymen exerted their influence against the listing of mining shares on the Stock Exchange but they have failed in their crusade against the Mining Exchange.

No one doubts the existence of untold gold and other minerals in our Western States and Territories, and if these mining properties are thoroughly worked it will be proved that we have Kaffirs of our own. Whatever the truth or falsity of recent reports of great new finds, the "boom" is proving an advertisement that will at-

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tract the capital necessary to bring the treasure to the surface. It will also attract poor men and adventurers by the thousands, however, and the prospect is that the advance army of goldseekers and workers will reach Colorado before the investors do, in which case there must be great hardships and suffering. It would only be just and humane, especially during the winter, for the State officers of Colorado to issue notices, for circulation throughout the country, describing the real situation and cautioning men who arrive on the grounds penniless of the ordeal that awaits them. Whatever Colorado is, it is no poor man's gold country.

A representative of The Irrigation Age visited Denver, Colorado Springs, the Cripple Creek region and Leadville soon after the present excitement began, and everywhere found the people holding the greatest faith in the gold production. Speculation was wild. At Colorado Springs three exchanges were crowded with frantic men all day. Sales of Cripple Creek in one week aggregated 11,852,457 shares. Streets were crowded and sidewalks blocked. The exchanges at Victor, Pueblo, and Denver were all making

heavy sales. Interviews with the managers of the various mines brought out the most extravagant statements. According to these gentlemen there was simply no limit to the gold. Ex-Gov. James B. Grant, of the Omaha and Grant Smelter, had just returned from a tour of inspection among the mining camps of the State. By the way, it was this gentleman's report, telegraphed broadcast, that heightened the excitement recently. Among other things he said: "Cripple Creek far surpasses the wildest anticipations of those who had the greatest hopes for the future of Leadville. Cripple Creek will produce more gold in the next twenty years than any camp ever known. Leadville has produced over \$100,000,000 in the last seventeen years. When they have been mining seventeen years at Cripple Creek it is safe to say that the camp will have produced over \$500,000,000. I have no hesitation in saying that the mines of Cripple Creek will soon excel the famous mines of South

The Denver, Salt Lake City and San Francisco newspapers were devoting a

great deal of space to the year's output of gold. They all agree that in another year, with the increase of mining operations, Colorado. Utah and California will yield more gold than all South Africa.

Colorado's gold production for the year 1895 was \$17,000,000. The number of men employed in the metalliferous mines of the State in 1893 was 22,876; number present employed, 26,329. silver districts show a decided falling off, while the gold districts show a heavy gain. It is claimed that the Cripple Creek, Leadville, Gilpin, Clear Creek and Boulder county districts have just commenced to demonstrate their great richness for the reason that thorough exploitation has not before been practiced except in a few isolated cases and, as a result, thousands of men will ultimately find employment where formerly only a few could be accommodated.

J. J. Crawford, California State Mineralogist, sends The Irrigation Age the official statement of the State Mining Bureau for last year, which shows that the value of the mineral product, including the metallic and non-metallic, hydrocarbons and gases, and structural materials, was \$20,203,294. Gold leads all the rest, with a total of \$13,923,281. Calveras county produced most of the precious metal, with an output of \$2,119,365. Petroleum, which is a developing branch, comes second in point of wealth. The State's product of this was valued at \$1,064,523. Silver amounted to \$207,331 and quicksilver to \$934,000.

The governor of Arizona says that Territory produced the past year \$10,000,000 in gold, against \$4,000,000 in 1894.

Alaska's gold output for 1895 is estimated by G. H. Swinehart, editor of the Alaska Mining Record, of Juneau, to be \$3,000,000. Of this amount \$800,000 has been obtained from placer mining, chiefly along the Yukon river. Mr. Swinehart says there are fifteen mills, with a total capacity of 500 stamps in operation.

America is holding her own as the leading gold nation. Last year we led South Africa. The latter mined \$39,555,836, while the United States mined \$39,775,000. For 1896 the prospects are great, and Alaska is beginning to tell.

THE DIVERSIFIED CAR

In diversified farming by irrigation lies the salvation of agriculture

HOW AND WHEN TO IRRIGATE.

BY F. C. BARKER, NEW MEXICO.

HOW and when to irrigate will depend so entirely upon soil, climate, weather, crops and many other varying circumstances, that no hard and fast lines can be laid down.

Take for instance the first question of whether we shall irrigate by small furrows, as in California, or on the moat by the flooding system. I maintain that it all depends upon whether the soil is porous and soaks laterally or whether the soil is the reverse, as it is where I live. Furthermore, the furrow system will suit certain crops while it will not do for others. The best system can only be found out by experience in each locality. Then, as regards the frequency with which crops should be irrigated. I venture to say that no one can fix this by any given number of days. Different crops require different treatment, and even the same crop will need more or less water according to the conditions of soil, weather and climate. The only rule one can lay down is that no crop needs water so long as the soil about the small roots nearest the surface is wet enough to roll up into a ball; but the moment any of these small roots are in dry earth the plant or tree is sure to suffer.

Serious harm has been done to many orchards whose owners read in books or papers that in California they did not irrigate during winter, and accordingly applied the rule to land which received little or no rainfall in the winter, quite forgetting that the reason why they do not irrigate during winter in California is that that is their rainy season.

I have sometimes been amused by reading calculations of how many inches of water are needed for irrigation. Some writers have made a regular formula, as though it were an engineering problem, and, having arrived at the exact number of inches required by a crop, deduct the natural rainfall and think they have the whole question settled. Now, in the first place, the rain may come when it is not needed, and again it often falls in such small quantities at a time that it rapidly evaporates and thus does very little to-

ward assisting irrigation.

No one can farm successfully with irrigation any more than without it who does not understand plant life sufficiently well to know when water is needed by a tree or plant. It requires experience like every other branch of farming. The inexperienced man may make a failure by not giving enough water to keep the roots moist right down to the bottom, or he may, and frequently does fail through giving so much water that the soil becomes waterlogged and deprived of air; but a still more frequent cause of failure is the omission to cultivate the surface of the soil after each irrigation. It is only by actual experience gained in each locality that the farmer can learn how and when to irrigate.

Fertilizers for Potatoes.—Like all other farm products, potatoes yield in proportion to the soil in which they are grown. To have a good crop, the land must be reasonably good, and to maintain its fertility the soil must be fed by some means.

If barnyard manure is used, it should not be coarse, or it will do more damage than good, in burning the vines. And, again, it must not be hauled out in the spring and only partially plowed under. The manure should be rotted sufficiently to be thoroughly incorporated in the soil, and be hauled out in the winter or early spring and plowed under, deep.

Potash and phosphoric acid are the principal elements of plant growth needed, and in many cases these can be supplied to a better advantage by purchasing and using commercial fertilizers than in any other way; because they contain a good percent of potash. Wood ashes can often be used to a good advantage in growing

this crop.

Bone dust is a good fertilizer for this crop, but it is usually not as readily soluble as is what is generally considered a good grade of complete fertilizers, but the bone meal is usually more lasting in its effects.

Let the material used be what it may, it is very essential to have it thoroughly incorporated with the soil, while with care very good results can be obtained by applying in the hill. The best growth and yield can be secured by applying broadcast.

This, of course, requires a larger quantity, but it is less work to apply, while more benefit can be derived. When animal manure is used, a good plan is to apply after plowing, and the work of properly preparing for the seed will work sufficiently in with the soil, but with ashes or commercial fertilizers, if applied broadcast, a good plan is to partly work the soil into a proper tilth, then scatter the fertilizer broadcast, and one or two good harrowings will work sufficiently into the soil. In neither case should the fertilizer come in direct contact with the seed.

Something for Market.—A farmer, who is always complaining about hard times, poor crops and the poor markets for farm products, went to a neighbor farmer to borrow money with which to

pay his taxes.

On entering the door he noticed an egg box well rounded up with fresh eggs ready for market. Just inside the pantry door was a large pailful of butter prepared for shipment. While talking about the good price being paid for potatoes the money lender remarked that he had several hundred bushels of good potatoes for sale. He also had several tons of hay to dispose of at the good price then being paid. He always kept a small bunch of sheep, and as he did not want to increase. his flock the increase of last season must be sold. This numbered forty head, which were fat and ready for the market at the highest price. The others would soon yield a fine clip of wool. The granary contained a great deal more wheat, corn and oats than that necessary for seed, bread and feed for the animals for another In an old-fashioned smokehouse was hanging a lot of pork which could not

be consumed by the family during the season, and of course a portion of it was for sale. The moneyless farmer stated his mission, was furnished with the money he desired and at once started for home. He wore a downcast expression, and his gait indicated that he was thinking. What his thoughts were we leave the readers of the Age to conjecture.

Profits of Gardens. — A half-acre fruit and vegetable garden well cared for as a market is worth from \$100 to \$200 to any intelligent farmer's family in this State, says M. A. Thayer, president of the Wisconsin State Horticultural Society. A good garden, he says, will often banish the doctor from your house and the sheriff from your door. It will make the boys and girls love the farm when everything else fails. Last season he harvested 2,500 bushels of strawberries. The cost for cultivating, picking and marketing was five cents per quart, and the berries were sold at an average of eight and threefourths cents per quart. The farmers who purchased the berries paid two cents for raising them, one cent for picking, one cent for crating, one cent for delivering, and the balance amounted to 375 per cent above actual first cost, counting the retail price at ten cents per quart.

Can farmers afford to pay such profits when they can just as well be reaping the harvest themselves? The way to prevent what some farmers may call wholesale robbery is to grow the berries at home. The cost of plants is but small and the work required to put out a half acre of small fruits is but a trifle when the profits are considered. Other small fruits and vegetables are equally as profitable

and as much desirable.

Dairymen Must Organize.—In the past, dairy farmers have been the victims of sharks on all sides. They are awakening to the fact, however, that there is a way of protecting themselves and dairy interests generally by organization, and these organizations are being entered into freely. The victory over oleomargarine or "hog butter," should be a great encouragement to these farmers to go further and root out the numerous other evils, among them bogus cheese. By organization, prices can be regulated in a

measure and expenses can be reduced, and the various sharks that beset dairy interests can be driven off.

As to the cost of running a dairy in a first-class way, the following official figures will be of great importance. They show the receipts, expenditures and profits of the Ohio State University dairy for a year:

 Pounds of milk produced
 160,554,000

 Receipts for milk
 \$3,842.75

 Cost of food
 983.76

 Cost of labor
 1,595.44

 Total expenditures
 2,579.20

Net gain.....\$1,333.55

There was an average of about twentysix cows actually in milk in the dairy during the year. As cows are bought and sold, not the same twenty-six cows were in the herd throughout the year. There are generally, also, three or four dry cows in the herd. From the summary it will be seen that for the number of cows actually in milk 6,175 pounds of milk were given per cow. The cost of food per cow was \$37.83, and the cost for labor was \$61.36, making the total expense per cow in milk, nearly \$100. The labor, however, included a considerable amount of experimental work and also the labor of taking care of dry cows, heifers, calves and bulls. It also includes the cost of retailing the milk. The cost for food only relates to the cows in milk. Assuming 8.6 pounds per gallon of milk, the cost of food per gallon of milk is 5.2 cents, the cost for labor per gallon of milk 8.5 cents, while the average price received for milk on this basis was 20.5 cents. It will be seen that the average cost of a gallon of milk retailed to consumers was 13.7 cents. The real cost, however, is somewhat greater than this, because more than 8.6 pounds are required for a gallon of milk when peddled to the consumers. It is worthy of notice that the work was all done by students, for which, it will be seen, they received \$1,595.44. The gross income from each cow actually in milk was \$147.80, the expense \$99.19, leaving a net income per cow of \$48.61, or, for a herd of twentysix cows, a net gain of \$1,333.55.

Cherry Culture.—In planting cherries avoid all conditions that are calculated to force a strong growth of wood and select sites that will tend to retard

development in the early spring. Fruit buds if too far advanced are liable to be killed by the late frosts when the tree itself is quite hard. To prevent the bark bursting, as is frequently the case in the West, the tree should be trained to branch near the ground. The low branches seem to be the better method for growing cherries in all the Western country. In Russia, where the cherry is successfully grown, the bush form has proven the most convenient and best producer. The trees should be planted on rather light, well-drained soil, on a northern slope if possible. Water should be used sparingly and the soil cultivated sufficient to induce a moderate and definite annual growth.

Do Your Hens Lay?-Yes, I feed my forty-five pullets three mornings in the week, six quarts finely chopped hay, timothy and clover mixed, six quarts boiling water and two quarts each of bran and middlings; two mornings, four quarts of small potatoes and turnips boiled, mashed and mixed with two quarts each of bran and middlings, and two mornings, the same amount of bran and middlings mixed with scalding hot milk. At noon I throw a basketful or two of chaff from the barn floor to them. At night I give three pints of wheat or, when very cold, two quarts of corn heated in the oven. Sometimes I substitute a quart of oil meal for the two quarts of middlings in the morning. In addition the hens have all the bones from our beef and pork, oyster shells and scraps from the lard and tallow. The latter, chopped fine, are fed twice a week, three pints at a time in the morning.

The Irrigation Farmer.—Irrigated farms have a tendency to induce their owners to cultivate crops that will pay the largest profits, and the irrigation farmer is, in a vast majority of cases, a man of high intelligence, who studies to make his land as profitable as possible. He has broken loose from the traditions of his forefathers because he is surrounded by different conditions. He has learned what it means to control the water supply of his land, and he seeks to take advantage of this tremendous lever to cultivate his acres. Farming, with him, is a science, in which he has learned that the conditions which tend toward success are greatly in his favor, if intelligently applied,

and he uses this intelligence to produce the best results. Water is the predominating element in farming in the arid region, and its value will never be less than at present, while its average cost is likely to diminish through the use of improved methods for its conservation and distribution.

The Kansas Corn Crop. - Secretary Coburn of the Kansas Board of Agriculture has just issued his final crop-report for the year. The item of foremost interest is the yield of corn. The secretary says: "The yield for this year, with one exception, is greater than in any previous year in the State's history and ranks Kansas one of the four banner corn States of the world. The total product is 201,457,-396 bushels, an average yield on the entire area planted (8,394,871 acres) of twenty-four bushels per acre. The average price of corn for the year is given as 23 cents per bushel and the price at which it is being sold or contracted (delivered) in the principal corn counties ranges from 16 to 21 cents and averages 18 cents. Thirty-three per cent of the crop is reported as likely to be disposed of at the latter average by the close of the year."

The Broom Corn Crop shows a very large increase in acreage over '94 in Kansas, amounting to more than 50 per cent, while in Illinois a small decrease is apparent. The total acreage of the country is estimated at 200,100 acres, or more than double the area cultivated in '89, as returned by the census. This, taken in conjunction with the average yield per acre, as computed by Orange Judd Farmer, points to a '95 crop of 57,000 tons, compared with 19,300 tons in '89.

Low Priced Potatoes.—Not in years have potatoes sold as low in Chicago, South Water street merchants complaining of excessive offerings and a difficulty in clearing up accumulations. In Wisconsin large quantities are being stored in pits, subject to frost damage, and Minnesota and the Dakotas are equally loud in their complaints of a lack of market. especially if some distance from railway. Chicago receipts have been as great as 100 cars per day and recently as many as 275 cars, or 130,000 bushels, were on track awaiting

sale, against an average daily consumption of 30 cars, leaving the surplus for shipment.

That New Insecticide "raupenleim," or German insect lime, is proving wonderfully useful and effective in combating a wide variety of insect pests. The main objection to it is the cost, but this has been met by an American imitation called "dendrolene" that is much cheaper and apparently quite as effective. The New Jersey experiment station deserves the credit of introducing and testing these new compounds.

Cow Peas.—The fertility of a large peach orchard in Georgia is kept up by sowing cow peas between the rows, and letting large numbers of hogs harvest them in November and December. Peas are a much better feed for young hogs than corn. How difficult it is for us to get away from the belief that corn is the only crop we can grow with success and profit for the hogs!

Kaffir Corn.—The farmers of Oklahoma have been experimenting with the new Kaffir corn, and they are now ready to declare that it will bring more money to the farmers of the United States than all of the famous gold mines of the Kaffir country from which it comes. Nebraska, Kansas and other States are also growing it

Winter Oats.—Letters from experiment stations throughout the central West show that winter oats have been tried in but a few localities north of the Ohio; that practically no systematic tests have been made of them in all that region, and that they have been most successful in the extreme Southern portions.

Beans not Seeds.—The question was taken all the way up to the United States Supreme Court, and that body has decided that beans are not seeds but vegetables.

Pumpkins and Turnips, fed with meal, will make a better appetite and guarantee those important streaks of lean and fat which command the best prices.

Ducks for Profit.—Only in exceptional cases should any more mature ducks be kept than are needed to produce the eggs necessary for hatching. Two good drakes and ten hens, if kept in a good, thrifty condition, will lay a sufficient number of eggs to hatch out a thousand young ducks.

A Necessity.—Another year with its usual dry spell convinces us more than ever that something must be done, something raised on the farm that can tide domestic animals over these periodic droughts; and sorghum comes as near answering the purpose as any crop we know of.

Overcrowding, wrong ventilation and filthiness of quarters are three evils that will be responsible for many cases of roup, diarrhea or cholera among fowls during the winter.

Give Charcoal.—Place a box of coarsely pulverized charcoal where hens can help themselves when they want it. They will eat a large quantity in a season, and it has a cleansing effect on the system and prevents many disorders of digestion.

Holding Their Corn.—Many farmers throughout the whole country, who can afford to do so, are holding their corn for a better demand and better prices.

The Wool Clip of the United States for the year 1895 is estimated as follows: The total product, washed and unwashed, is put at 294,296,726 pounds, as compared with 225,210,602 pounds for the year previous. Reduced to a scoured basis the total clip for this country was 125,718,690 pounds.

Grain Weighing.—A movement is on foot to have the system of weighing grain reorganized in such a way that the seller will not be defrauded of a portion of his grain by carelessness, or worse, among those who weigh it when received at Chicago.

Warm Water—Hanford Reynolds, in Hoard's Dairyman, insists that in the winter time cattle, horses and other stock should be given warm water. He urges

that the ice water not only causes suffering but prevents fattening.

Don't let the manures leech out and rot out in the heaps around the stables. Haul to the fields and meadows as fast as they accumulate and you will be all right.

If Worms are eating the grape leaves a solution of white hellebore will stop them.

Simple.—An Iowa farmer claims to have saved his hogs from cholera by feeding them pumpkins. He says the seeds did the work.

Electrical Incubators are the latest idea in artificial hatching.

INSPIRATION.

[J. Laidlaw on the situation in the central Western States.]

My fields of grain I drove across
To figure out my gain or loss—
But all around it seemed I heard,
Said to my soul this curious word—
"Irrigate."

I trod my dusty corn fields thro'
And picked the ears so small and few,
But every nubbin I let fly
Seemed in my dust-filled ear to cry—
Irrigate!

My half starved bairns so thinly clad, My worn out wife so pale and sad, My ragged clothes—my courage gone,— My shabby home, all seemed to moan Irrigate!

And debts and duns were crowding thick, And shades of sheriffs made me sick, And merchants watched me keen and close, While from their lips this word arose— Irrigate!

A tented wagon moving South, Some poor starved victim of a drouth, Or hunted thief—me come to this!— I hear my wagon creak and hiss— Irrigate!

I raised my soul in prayer to Him Who feedeth serf and seraphim, To aid and bless—across the night Flashed out the burning word of light— Irrigate!

Down in the sunless caverns hid, My riches but await Thy bid— Go make the watery treasures come To glad thy fields and bless thy home— Irrigate!

AGRICULTURE AND COMMENTAL AND

Senator Stewart, of Nevada, woke the Senate up the other day. He said the great depreciation of silver gave to the cheap labor of Asia a tremendous advantage in competing with the domestic products of the American market. Japan, in particular, he said, was profiting by this difference of 50 per cent between our money and that of Japan, and Japanese merchants were to-day underselling our home producers in many lines of goods.

The latest statement of the visible supply of grain, as compiled by the New York Produce Exchange, is as follows: Wheat, 66,835.000 bushels; increase, 3,049,000 Corn, 5,227,000 bushels; inbushels. crease, 20,000. Oats, 6,134,000 bushels; increase, 123,000 bushels. Rye, 1,555,-000 bushels; increase, 104,000 bushels. Barley, 4,475,000 bushels; decrease, 279,-000 bushels.

A cable between the United States and Hawaii has been incorporated, and it is predicted that at no distant day the line will be extended to Australia and China.

According to the last census report more than \$100,000,000 are invested in "truck farming," mostly early vegetable production, in the United States, and the annual yield from the 534,440 acres of land so occupied is \$76,517,155 net after paying freights and commissions, or over \$143 per acre net cash returns.

Thomas G. Merrill, of Montana, chairman of the Finance Committee of the National Bimetallic Union, says: recommendation of the President to retire greenbacks, if carried out, would be disastrous to the silver interest. The retiring of the national currency, issued under the Sherman act, which has been the means used for the recent heavy withdrawals of gold from the Treasury, would mean that the bullion in the Treasury would be thrown upon the market, causing a decided decline in the price of silver."

In attendance on the Illinois State Grange at Springfield were 165 delegates, while sixty-five delegates were in attend-

ance on the annual convention of the Pomona Grange, an organization devoted to women. During the year twenty-five new granges were organized, with 300 members, making 1,700 Granges in the State, with a total membership of 8,000.

The movement to have the Michigan State Grange indorse ex-Governor Luce for president of the Michigan Agricultural College was abandoned, but the Grange spoke out as to the manner of man who should occupy that position, and recommended an amendment to the law requiring that members of the board in charge of the college be elected by the people instead of appointed by the governor as now.

Officers elected at the meeting of the Indiana Grange were as follows: Master, Aaron Jones, South Bend; overseer, P. B. Ewan, Hayden; lecturer, F. J. S. Robinson, Cloverdale; steward, G. W. Sawdon, Aurora; assistant steward, G. W. Laird, Columbia City; chaplain, Milton Trusler, Connersville; treasurer, J. W. Holmes, Cortland; secretary, T. B. Frazier, Frankfort; gatekeeper, O. M. Curry, Terre Haute.

The Illinois Patrons' Aid Society elected the following officers: President, D. O. Trotter, Jersey county; vice-president, Mrs. M. M. Baker, McLean county; secretary, H. K. Smith, Putnam county; treasurer, Mrs. R. Newman, Coles county; board of managers, C. W. Gree, Marion county; J. P. Smith, St. Clair county; Fred Helms, St. Clair county.

Progressive members of the Chicago Board of Trade are holding meetings and considering a plan for a change of methods in trading. The proposition is to compel the elevators to do business on a cash basis. It was shown at a recent meeting that \$20,000,000 is annually paid for carrying grain that does not exist.

Farmers seldom fail, but it is well enough for them to be posted. If a farmer is mortgaged and it finally comes to the worst, he should make an assignment, and not give up the farm to the mortgagee. By this plan he may save something to himself after the debt has been paid, while in the other case he loses the farm and gets nothing.

That famous steer belonging to Hetfield, of Watseka, Ill., which weighed 4,000 pounds, has been sent to the Chicago stockyards. The animal has been exhibited at many fairs during the past few years and is said to be the largest steer ever raised in Illinois.

Standard silver dollars actually in circulation Nov. 1 were 58,354,092, out of a total of all kinds of money of \$1,598,859,316. Gold coin 475,181,593, subsidiary silver 63,832,759, the remainder being paper money. The per capita circulation is placed at 22.72.

In eleven months silver shipments from the Pacific coast to Hong Kong and other Chinese and Japanese markets were over \$16,500,000 against \$12,000,000 in 1894. This accounts for the small shipments of silver from London to the Eastern markets.

Total imports of merchandise during November, \$63,343,759, of which \$32,539,725 was free of duty; for 1894, \$50,567,482, of which \$23.934,666 was free of duty. During the previous eleven months the imports amounted to \$730,416,217, against \$614,177,510 for 1894.

Total amount of domestic exports during November, \$85,151,267, against \$78,887,384 for November. 1894; for the previous eleven months, \$716,664,832 against \$723,648,063 in 1894.

The National Live Stock Exchange elected the following officers: President, William H. Thompson, Chicago; treasurer, L. B. Doud, Chicago; secretary, Charles W. Baker, Chicago; vice-presidents, D. McN. Palmer, St. Louis; W. B. Stickney, East St. Louis; J. G. Martin, Omaha; J. H. Nason, Sioux City; L. B. Doud, Chicago; John Payne, Kansas City; W. E. Skinner, Fort Worth, Texas. Executive Committee: W. H. Hines, Charles Jones, St. Louis; E. B. Overstreet, C. M. Keys, East St. Louis: J. A. Hake, D. L. · Campbell, Omaha; H. D. Pierce, W. M. Ward, Sioux City; C. A. Mallory, Irns Coy, Chicago; E. G. Bridgeford, J. C. McCoy, Kansas City; G. W. Simpson, C. W. Simpson, Fort Worth.

The board of directors of the American Shorthorn Breeders' Association are: W. E. Boyden, Delhi Mills, Mich.; H. F. Brown, Minneapolis, Minn.; Emory Cobb, Kankakee, Ill.; J. B. Dinsmore, Sutton, Neb.; W. A. Harris, Linwood, Kan.; A. H. Jones, Delaware, Ohio; C. E. Leonard, Boonville, Mo.; S. F. Lorhridge, Greencastle, Ind.; John McHugh, Cresco, Iowa; J. Frank Prather, Williamsville, Ill.; Abram Renick, Sycamore, Ky.

Representatives from every county in the north half of the State were present at the recent meeting of the North Central Illinois Poultry Association at Princeton.

The Farmers' Institute for Northeastern Indiana has just closed a big meeting at Butler. Col. J. H. Brigham, Prof. W. C. Latta and many other leading lights were present.

The very latest exhibition scheme, suggested by the various exhibition trains, contemplates the circling of the earth with a fleet of splendid expedition ships to show the world what America can make and grow. The scheme calls for the construction of one or more expedition ships, where space can be rented for the display of the products of both the soil and factory upon the same principle as is done in expositions, except that in the proposed floating exposition only American products shall be exhibited.

Reports from Topeka say that several weeks ago a carload of hogs were shipped into Harper county, Kansas, from Nebraska. They were diseased, and since then over 1,000 head of hogs have died with cholera. The epidemic has spread into three counties.

The National Grange elected the following officers for the ensuing term of two years: Master, J. H. Brigham, Ohio; overseer, Aaron Jones, Indiana; lecturer, Alpha Messer, Vermont; steward, J. L. Cox, New Jersey; assistant steward, A. J. Newcomb, Colorado; treasurer, Mrs. E. S. McDowell, New York; secretary, John Trimble. Washington, D. C.; gatekeeper, W. E. Harbaugh, Missouri; chaplain, O. N. Hale, New York; Pomona, Mrs. Sarah G. Baird. Minnesota: Ceres, Mrs. Lucy G. Smith, Ohio; Flora, Mrs. L. E. A. Wiggin, Maine; lady assistant steward, Mrs. S. G. Knott, West Virginia. Executive Committee, J. J. Woodman, Michigan; N. J. Batchelder, New Hampshire.

Wool importers have just opened a great Wool Exchange in New York. It is an eleven story fire-proof building and cost \$1,000,000. This enterprise alone indicates what the free traders in wool expected. But the best laid plans, etc.

Transcontinental freight rates will be advanced by the Panama Railroad Company and all of the overland roads at a meeting soon to be called in Chicago or New York. The advance, it is said, will be the result of the new contract recently made by the Panama road and the Pacific Mail Steamship Company, by which the former is given the right to fix rates on west bound shipments.

George L. Bowen, president of the Textile Manufacturers' Association of the South and West, has called a meeting of the association in Chicago on the 14th inst. for the purpose of deciding on the association's position in recommending legislation calculated to relieve the financial stringency. The association numbers 1,200 manufacturers of cotton and woolen goods, operating 2,000,000 spindles and 1,000 sets of wool cards.

Patriotic decorations and patriotic speeches were the order at the American commercial banquet given at Delmonico's, New York. It was the centennial celebration of the Jay commercial treaty with Great Britain as well as the inauguration of the annual observance of "Commercial Day" by all organized commercial bodies.

A blanket mortgage for \$175,000,000 given by the New York. Lake Erie & Western Railroad to the Farmer's Loan and Trust Company of New York has just been filed.

Some Illinois postmasters just confirmed are: A. M. Davis, at Rossville; C. L. Corneau, at Forrest; W. W. Twist, at Toluca; E. K. Mercer, at Princeton; D. C. Marsh, at East St. Louis; D. F. King, at Roodhouse; F. Friede, at Mount Olive; R. Forester, at Murphysboro; J. A. Dufield, Woodstock; J. Clark, Morrison; N. Flack, Milford; H. S. Coffeen, Homer; M. Maloney, Dixon; E. S. Clemens, Chester; J. D. Martin, Carmi; W. B. Fleming, Bement.

An assignment has been made in the County court in Chicago, by the Illinois Live Stock insurance company. Homer S. Galpin is named as assignee.

But recently Manitoba and the Cana-

dian Northwest Territory were the home of men little better than savages; and yet, in the past year, nearly as much wheat has been raised in that region as in the whole

of the United Kingdom.

H. C. Wheeler, the big Sac county (Iowa) farmer who ran for governor four years ago and who changed from horse-breeding to dairying, has got his milking machine in operation, with which 100 cows are milked in one hour. A gas pipe passes along the stalls to which is attached a rubber tube and cup, which is clasped over the teats of the cow. The milk is drawn by suction or pressure furnished by machinery. The milk is carried to a large reservoir. But two men are required to do the milking. The cows seem to enjoy the process better than when the hands are used.

Postmasters just confirmed in Kansas are as follows: A. G. Patrick, at Oskaloosa; J. L. Mattingly, at Sedan; G. W. H. Lucas, Cherokee; Robert Kennedy, Pleasanton; J. C. Haskett, Baxter Springs; L. B. Davidson, at Girard; C. P. Baldwin, at Belleville.

A correspondent writing from Hillsboro, New Mexico, says he has what can be called a true hybrid—a cross between wheat and winter barley. It has a tendency to take the two-rowed barley head,

but is very large and plump.

Government reports just made show that the exports of gold during November aggregated \$14,066,460, an excess of exports over imports of \$13,473,876, against an excess of \$1,507,388 in imports over exports for the same month in 1894. The exports of gold during eleven months in 1895 amounted to \$89,130,639, as compared with \$92,017,535 for the same months, in 1894.

The exports of silver coin and bullion during November amounted to \$5,418,091, and the imports \$1,017,503. The exports during November, 1894, were \$3,608,778,

and the imports \$727,050.

The new Kaffir corn, grown in Oklahoma and Kansas, is pronounced wonderful. A Medicine Lodge (Kan.) miller experimented and finally produced Kaffir flour which will create a revolution in the world's breadstuffs. Bread made from it is sweet to the taste, highly nutritious and satisfactory to the eye, being about the color of the best graham bread.

THE FUTURE OF PRICES

THERE is general faith in the future of prices for corn and wheat. Bankers and syndicates are advancing means to farmers and stock raisers in the West so that they may be enabled to hold their stock for a time. Something agriculturists should know is the fact that an Eastern company is buying up corn in the West at the cheap prices to hold it for a rise.

Prices of beef cattle at the Union Stock Yards in Chicago have been weak and lower all around. Country holders, just now, seem to be rushing their stock in. In a single week the receipts were 76,000 head. Of hogs, the receipts the same week were 240,000, an increase of nearly 50,000 over the preceding week, prices ranging at \$3.50 to \$3.65 for all weights. As to the future of prices for cattle and hogs no good prediction can be made. The bulls claimed that there must be an advance after the holidays, while the bears "explained" why prices should rule lower. A steady market for sheep is likely during the winter.

Receipts of cattle in Chicago for the year up to Dec. 1, show a decrease from 1894 of 395,352 head. Notwithstanding this great shortage and the alleged combine of the "Big Four," prices went down to the present low figures. Receipts of hogs for the eleven months show an increase of 356,171 head, Receipts of sheep show an increase of 333,967. The increase of horses was 17,511 head.

The trolley and bicycle have certainly ruined the market value of their predecessors. An auction sale of horses from the Chino ranch at San Barnardino developed the fact that there is less demand than ever for such animals. The prices ranged from \$2.00 to \$17.50 and some of the horses sold were ones which a few years ago would have been in demand at \$100. Richard Gird has made the raising of horses one of the features of his ranch, but since there is no longer any profit in the business he determined to dispose of them, which accounts for the

auction. One splendid looking gray mare, with good style, went for \$6.50. Another pretty bay was knocked off for \$2.00, and so the prices went throughout the sale. A team of beautifully matched bays, with splendid black mane and tails, finally went for \$35.00, \$17.50 each. This was the best price obtained for any of the horses sold.

Of wool Dunn's latest report says: "The market has not advanced with London sales as was expected, and 5,536,100 pounds have been sold; 2,303,700 pounds foreign against 5,479,300 in the same week of 1891, of which 1,413,500 were foreign. The slow market for goods hinders dealings. Manufacturers have had a profitable season though trade is dull now."

Of the future of the flour market at Minneapolis, a reliable correspondent says: "Lake shipments have closed for the season, but the prospect is that the production will be maintained at a comparatively large figure during the winter. If reports coming in to local millers are true, trade is getting back to the demoralized shape that it was in before the advent of the new crop. The latest net quotations at the Minneapolis mills for car or round lots were:

	Per 196 lbs.		
	Present.	Year ago.	
First patent, in wood	\$2.85@3.30	\$3.15@3.50	
Second patent, in wood	2.65@2.85	2.90@3.05	
Fancy clear, in wood	2.15@2.45	2.15@2.30	
Second clear, in bags	1.60@1.70	@	
Low-grade, in bags	1.40@1.50	1.80@1.90	
Red-dog, in bags	1.05@1.10	1.40@1.50	

Local prices at Minneapolis on flour to grocers and retailers are, per 196 lbs. in sacks, \$3.30 for patent and \$3.20 for straight. Most grocers, in selling to consumers, add 50c per bbl. as their profit.

The output of flour at three mill points—Minneapolis, Superior-Duluth and Milwaukee—for the week ending Dec. 14 was twice as much as during the same week in 1894, or 360,635 barrels against 151,925 barrels.

THE PROGRESS OF WESTERN AMERICA

A PROMINENT CALIFORNIA ENGINEER.

WE herewith present to our readers a likeness of F. C. Finkle, C. E., who is the author of the article on "Water Supplies for Irrigation," the publication of which is begun in the present issue of THE AGE. Mr. Finkle intends at some time in the near future to publish an exhaustive work on irrigation engineering, of which the present chapter on "Water Supply for Irrigation" will form a part substantially as it is published herein. The Age has made arrangements to publish this one chapter in advance of the issuing of the book, which will contain eight or nine other chapters equally as complete and interesting for students of irrigation engineering and irrigation engineers as well as for practical irriga-



F. C. FINKLE, Mem, Am. Soc. Irr. Engs. of San Bernardino, California.

tors, but dealing with other topics of irrigation engineering, so that the whole subject will be fully covered in the book. From a perusal of this chapter it will be readily seen that the book to be published by Mr. Finkle will be wholly different from any book heretofore published on the subject. It will contain all the scientific matter applicable to the subject, all results of experiments, all rules and formulæ applicable to irrigation engineering and a full discussion of the best practice in all the branches of the science, including a large amount of matter heretofore never published, or entirely original. Such a work is now in urgent demand and the publication of Mr. Finkle's book will be eagerly looked forward to by all interested in irrigation and irrigation engineering.

In this connection it is proper to give a short sketch of the accomplished hydraulic engineer, F. C. Finkle, who is the author of this work. Mr. Finkle is undoubtedly one of the most highly-educated and able men in the engineering profession at the present time. He is a very fine mathematician as well as a man thoroughly well versed in the classics, and modern languages. His knowledge, therefore, does not alone cover the subjects connected with his profession, but includes a thorough knowledge of Latin and Greek as well as a reading, writing and speaking knowledge of English, French, German, Spanish, Italian, Danish, Swedish and Norwegian, in all eight modern languages. This knowledge has aided him very materially in collecting the material for his book.

material for his book.

Mr. Finkle first prepared for his profession by taking a special course in the University of Wisconsin, after which he completed his knowledge by studying and traveling abroad for over two years. Since that time he has been located at San Bernardino, Southern California, one of the most important irrigated sections in the world, where he has been actively engaged in the practice of irrigation engineering. His practice has extended all

over Southern California as well as some parts of Mexico and the Western States and Territories. Some of the important works of which Mr. Finkle has had exclusive charge as Chief Engineer are the Jurupa Canal, Water Works of the City of San Bernardino, the irrigation systems of the Grapeland Irrigation District, and of the East Riverside Irrigation District, and the Vivienda Pipe Line, all of which are in Southern California. In these and other enterprises he has had a great deal to do with developing water supplies, designing works and superintending construction and surveys. During all the time he has practiced his profession he has been engaged in doing consulting and expert work for companies for which he has not been chief engineer and has experted some of the most important litigated cases and water properties in the west.

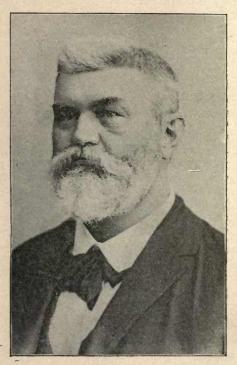
He has also contributed at various times to irrigation literature, although his practice has prevented him from doing as much of this as he would like to have done.

Mr. Finkle desires any one having criticisms on the chapter on "Water Supplies, etc.," to correspond with him, and due acknowledgment will be given in the book, when published, to all who may discover errors in the manuscript or



F. H. NEWELL, Of the Geological Survey, Washington, D. C.

who make valuable suggestions. The manuscript never having been reread and rechecked, as yet some slight errors may be found to exist, which, if there are any, should be corrected before it is published in book form.



GEN. J. H. McLEARY, OF TEXAS.
President of the State Irrigation Association.

STATE CONVENTION AT SAN ANTONIO, TEXAS.

'HE general interest and progress in irrigation in Texas was well indicated by the representative State meeting held at San Antonio. It was the second annual convention of the Texas State Irrigation Association, and the deliberations occupied two days, with night sessions. Prominent gentlemen in attendance were J. H. McLeary, San Antonio; T. M. Paschal, San Antonio; P. J. MacMahon, Laredo; W. B. Parish, Seguin; A. Sinclair, G. Q. A. Rose, San Antonio; F. Vandervoort, Carrizo Springs; W. S. Marshall, Fort Worth; W. D. Kingsbury, Boerne; Prof. A. E. Blount, Las Cruces, New Mexico; J. M. Mathews, W. W. King, A. F. Dignowity, N. T. Ayres, J.

W. Watters, Edwin Chamberlin, G. S. Simons, T. W. Woodruff, San Antonio; I. M. Cline, Galveston; James C. Atkins, Portland; W. J. Hollingsworth, Brownwood; Marshall Burney, Kerrville; John Hord, Rio Grande City; J. A. Bell, Laredo, and others.

There was the enthusiasm and good feeling which is always evinced in a Texas gathering of any kind, especially when the people are united in a great cause.

Judge J. H. McLeary presided. After a brief address of welcome he said this was not a convention but a meeting of the Texas State Irrigation Association. "The objects and aims are to dot this country with irrigated farms, to make the desert blossom and to make that part of the country heretofore considered as only a stock range an agricultural country. When conducted by irrigation, crops are the most reliable, because whether it rains or not they can make the country rich and prosperous."

The secretary announced that the number of members in the association was

205.

A communication from the Southern Irrigation Congress was read, inviting Texas to send delegates to the next meeting of the Congress, at Nashville, in October, 1896.

A large number of interesting papers were read and discussed. Professor Hill of the United States Geological Survey read a paper on Artesian Well Irrigation, and explained at length the general subject of the economies of irrigation.

Like El Paso and the surrounding country, San Antonio being in the semi-arid region needs irrigation fully as much, from the fact that rains there are seldom, if ever, opportune. They come in quantities sufficient for all crops did they fall when needed most. The burden of all the papers read and the speeches made seemed to have been upon the conservation of the storm waters and the manner of conducting them out upon the land.

Mr. Bell, of Laredo, offered a resolution requesting all the Texas representatives in Congress to endeavor to have some of the government geological survey work provided for done in Texas, the purpose being to ascertain the amount of the State's water supply, information of exceeding value when a system of water storage is contemplated. Adopted.



EDWIN M. CHAMBERLIN,
of San Antonio,
Secretary of the Texas Irrigation Association.

After deliberation a plan was adopted for the thorough organization of the State by counties, the county associations to be part of the general State Association.

The election of officers resulted as follows: President, J. H. McLeary, San Antonio; first vice-president, F. A. Swinden, Brownwood; second vice-president, Edwin Chamberlin, San Antonio; secretary, W. D. Hornaday, San Antonio; treasurer, J. N. Brown, San Antonio; ser-

geant-at-arms, J. C. Carr.

The chairman named the following to comprise the committee on legislation: Henry Suyles, Abilene; C. E. Dutton, San Antonio; P. J. MacMahon, Laredo; F. A. Swinden, Brownwood; J. S. Taylor, Laredo; W. W. Turney, El Paso; William Casson, Zavalla county; J. L. Slayden, San Antonio; John Willacy, Portland; Robert W. Stayton, San Antonio; Albert Urbechn, Laredo; J. O. Nicholson, Laredo.

Authority to recommend to the governor appointments as delegates to the meeting of the Southern Irrigation Congress at Nashville was given to the executive committee.

Laredo was chosen as the place for the next meeting.

IRRIGATION IN THE SOUTH.

IRRIGATION was carried on here and there in various Southern States the past season. A Southern Irrigation Congress has just been organized and preparations are being made the present winter for general irrigation in 1896.

The meeting and organization at Atlanta was a great event. The City Council chamber was crowded. Dr. H. C. White, president of the Georgia State Commission of Irrigation, called the assemblage to order and delegates responded from all the Southern States. Hon. John Triplett, in behalf of the State of Georgia, the city of Atlanta and the Cotton States and International Exposition, welcomed the Congress in an eloquent speech.

The constitution adopted, among other things, provides that the organization shall be known as the Southern Irrigation Congress, and shall meet annually, officers being elected on the first day of each session.

State Commissions of Irrigation shall be created in each State represented in this Congress in the following manner: The delegates from each State shall recommend to the Executive Committee five proper persons in their State for appointment as members of the State Commission of Irrigation, and, if the Executive Committee approve, proper certificates of their appointment, for the term of three years, shall be signed by the President and Secretary.

The members of the Executive Committee are instructed to furnish the secretary of this Congress, from time to time, with statistics of irrigation in their respective States, that he may disseminate this information for the en-

lightenment of the people.

The work of this Congress is educational, and designed to bring out fully every fact connected with irrigation, embracing the proper drainage of land, the terracing of farms, the preservation of the forests and the utilization of the water-power at our command.

Officers were elected as follows: President, Prof. J. B. Hunnicutt, Athens, Ga.; vice-president, Hon. H. C. Gardner, Nashville, Tenn.; secretary. Major W. G. Whidby, Atlanta, Ga.; treasurer, Hon. John Triplett. Thomasville. Ga.; sergeantat-arms, Hon. Wilberforce Daniel, Augusta, Ga.; postmistress, Miss Kate Brasington, Cincinnati. Ohio.

Executive Committee—Alabama, P. H. Mell, Auburn; Arkansas, Jeff D. Wellborn, Kerrs; Florida, O. Chute, Lake City; Georgia, C. J. Bayne, Augusta;

Kentucky, H. C. Underwood, Atlanta, Ga.; Louisiana, Dr. W. C. Stubbs, New Orleans; Maryland, H. R. Walworth, Baltimore; Missouri, Dr. C. E. Edwards, Kansas City; Mississippi, S. M. Tracey, Agricultural College; North Carolina, Wade T. Hampton, Raleigh; South Carolina, J. C. Hemphill, Charleston; Texas, A. M. Soule, College Station; Tennessee, T. H. Webb; Virginia, J. F. Jackson, Richmond; West Virginia, A. B. White, Parkersburg.

The Chamber of Commerce of Nashville invited the Congress to hold its next session in that city. The invitation was seconded with spirit by the City Council of Nashville, the mayor of that city, the Board of Public Works and the Tennessee-

Centennial. Accepted.

Addresses were made as follows: Hon. C. R. Pringle, "The Preservation of Our Forests;" Prof. J. B. Hunnicutt, "The Full and True Meaning of Irrigation;" Frank P. Chaffee, Alabama State Weather Service, "Distribution of Rainfall and Moisture in the Southern States;" Percy Sugden, "Irrigation and Drainage of the Land from a Southern Standpoint;" Dr. W. C. Stubbs, Louisiana, "Irrigation."

Prof. H. M. Wilson of the United States Geological Survey gave a lecture on the all-absorbing subject. Lute Wilcox, by charts, illustrated the various methods of irrigating land, imparting

valuable information.

Papers were read as follows: Prof. A. M. Son a, "A Bit of Irrigation History;" Hon. J. S. Titcomb, "Suggestions;" Hon. J. D. Wellborn, "Irrigation in Arkansas;" Hon. J. E. Mercer. "Reclamation of Land by State Authority." Numerous talks and addresses were made.

The National Irrigation Congress sent fraternal greeting by four delegates—H. E. Heath, of Nebraska; Lute Wilcox, of Colorado; Frank Woodford, of Arizona, and A. E. Blount, of New Mexico.

The Tennessee Centennial Exposition is to be held at Nashville from September 1 to November 10, 1896, and the next session of the Congress will be held at Nashville during that time.

Among the resolutions was one giving the thanks of the Congress and of the entire South to Major W. G. Whidby, secretary, for inaugurating the movement which resulted in the organization of the Congress, and also to the Southern Cultivator for effective aid.

At the closing of the proceedings President Hunnicutt made a stirring address. He urged prompt and effective work and laid stress upon the importance of the Southern States having a grand exhibit of the products of irrigation at the Tennessee Centennial Exposition.

A SOUTHERN IDAHO SYSTEM OF WATER RIGHTS.

BY J. H. LOWELL.

IN 1893 a company constructed a canal designed to water 15,000 acres of bench land between the Boise and Snake Rivers, at Roswell, Canyon county, Idaho.

The first idea of the promoters was to sell water rights and charge a fixed annual rental, as is the custom of similar enterprises in this State, but upon a careful study of the situation they arrived at the following conclusions:

1st. That the owners of the land should also have the absolute ownership and control of the water.

2nd. That the annual maintenance fee should be charged on every acre of land for which water right is purchased, whether the land be cultivated or not, and that it should be sufficient for the proper operating and repair of the canal and no more.

In the absence of any State law authorizing an irrigation district (such a law has since been passed, but is practically inoperative pending the result of the California litigation), a company was incorporated known as the Riverside Irrigation District, Ltd., which was stocked on the basis of one share of stock to each ten acres of land covered by the system.

Water can only be obtained by the purchase of stock in the company, and upon the face of each certificate is a description of the land to which the water is made appurtenant. Based upon this certificate of stock, the company issues a water deed, conveying to the holder of the stock his proportion of water, and making the same appurtenant to the land for which the stock is purchased.

Incorporated in the deed are some provisions considered necessary for the proper and systematic administration of the com-



ARTHUR W. PHILLIPS,

Of Douglas, Wyo. The author of the "Mineral Wealth
of Wyoming," in this number.

pany's business, as for instance: Agreement as to control of gates and measuring boxes; to prevent undue waste; to restrict assessments to actual cost of maintenance; to provide method for levying assessments. By this means it is sought to guard against the sometimes loose methods of mutual or "farmers" ditches.

This deed is duly recorded and is made binding on the successors to the parties in interest.

Stock can only be transferred on the books of the company upon the presentation of a duly executed deed for the land to which the stock is appurtenant. In case part of the land only is sold, it carries with it its proportionate share of stock.

It is sought to make the water belong to the land rather than to the individual, and this we believe to be the true theory of the appropriation of water.

When any land is sold, the stock belonging to it is simply transferred to the new owner, and he holds the water right subject to the agreements and provisions of the original water deed.

Each purchaser of water stock is at once a full member of the canal company, entitled to vote, hold office and participate in all the company's business, and when

all the land under the system has taken water rights the canal will be entirely owned by the irrigators, who are the persons most vitally interested in its efficient and economical administration. This end being reached by degrees will obviate one source of trouble which has been felt under the California law, where men in the districts have been called suddenly to handle immense sums of money and large enterprises without previous experience or training.

At the same time the irrigator will obtain his water from the start at actual cost of maintenance. Under this system the annual assessment is estimated at not to exceed twenty cents per acre. Water

stock sells at \$10.00 per acre.

The above is given as an outline of a conscientious attempt to give a community the benefits of a district system in so far as it lay in the power of private individuals to do so.

IRRIGATION IN ALBERTA, CANADA.

THE following is a letter from Chas. O. Card, of Cardstone, Alberta, in reply to inquiries regarding irrigation.

You ask me in regard to my ideas of duty of water. I believe in most instances that fifty cents per acre will give a hand-

some return on capital invested.

All this will naturally be governed by the area that can be irrigated under the canal and cost of the same. In Alberta it seems to me that such a vast area can be irrigated with each canal and the water supply is so abundant in these large streams. I have tested to some extent by observation and levels and the water can be put on the land more cheaply than in the mountain valleys, because in the latter locations the land is usually in small strips that skirt the mountains here. Several townships in many instances can be irrigated from the same canal. You mention the Calgary Irrigation Company's covering about two townships. The canal must pass over very rough ground to cost \$4.00 per acre; but I presume you left a margin. I believe the average cost of irrigation in Alberta will not exceed \$3.00 per acre. The reservoir system in connection with these canals will be of vast benefit not only to

the investors, but to the consumers. My knowledge of the reservoir system is that crops thrive much better and give a greater yield under water that has been warmed in reservoirs, than so direct from the coldwater that is chilled by the melt-

ing snow.

I am confident that from the beginning in this only partially arid country, we will not require more than fifty per cent of the water that they do in the mountainous districts. We have an excellent strata of clay under our soil, besides, we have more rainfall and more dew. I am confident that, in most instances, one thorough irrigation will mature our grain crops. Our vegetables will usually require more. Probably two or three times. My experience this past season in irrigating our gardens is that not to exceed one-half is required to what I used on the same crop in some of the Western States.

GREAT STRIDES BEING MADE.

THE admission of Utah to Statehood is a great stride in the progress of Western America; and Arizona, New Mexico and Oklahoma are knocking. The general situation is well and briefly described by the Industrial Reporter, under the caption, "See Us Grow:" "The West has never had a brighter outlook than it has today. The great activity in mining has set the wheels of the commercial and financial West in motion and each month encouraging reports come from every section of the Mountain West in confirmation of this There is probably more prospecting going on to-day than ever before in the history of the country, and this means consumption of supplies and employment for thousands of men. The rich discoveries being made almost daily in the mining camps of Colorado, Utah, Wyoming, Arizona, New Mexico, Montana and Nevada are attracing capital from the East and abroad, and there is now ample means at hand for developing such mining claims as present a favorable showing. Land values, too, are constantly increasing, despite the fact that thousands of acres are being reclaimed every year and millions of dollars expended in the construction of irrigating ditches, pumping plants, etc. The iron and coal industries are also rapidly developing under the

pressure of a sharp demand, and, indeed, every feature of our Western industrial. development is moving onward and becoming a more powerful factor in swelling the grand total of our products and commercial importance. Building, too, is again reviving and the beneficial effect of the mining activity is to be seen in all the trades."

AN EMIGRATION BUREAU IN CHICAGO.

THE Canadian government is actively at work placing the resources and advantages which it has to offer in the Northwest before homeseekers, manufacturers and investors. An office has been opened in Chicago, where there is now on display an exhibit of the products of the provinces of Alberta, British Columbia and Assinoboia. The exhibit is at present comprised mainly of grains and grasses, with a few choice photographs of farming scenes and views along the line of the Canadian Pacific Railway. It is the intention to interest investors and manufacturers for the purpose of having them open the mines and establish factories, but the principal object of the work is to secure settlers and therefore the Dominion government is offering to the heads of families and other responsible persons a quarter section of land free.

Mr. Peter F. Daly, who has charge of the Chicago office, is an old railroad man and thoroughly understands the details of work of this character. His efforts are

already having good results.

The Dominion government has taken up this work along the lines advocated by The Irrigation Age during the past few years and it now remains to be seen whether the various Western States will be as enterprising and energetic as our neighbor on the North. The only way to get settlers is—to get them, and the Canadians in the Northwest and the people of the Southern States are working very hard in favor of their particular localities. What will the West do?

TRANS-MISSISSIPPI COMMERCIAL CONGRESS.

The eighth annual session of the Trans-Mississippi Commercial Congress at Omaha was fully attended, there being 300 delegates. President George Q. Cannon, of Utah, was in the chair. Utah, Iowa, Missouri, Arkansas, Kansas, Texas, Colorado, California, Arizona, Nevada, New Mexico, Washington, Oregon, Wyoming, North Dakota and South Dakota were represented. The delegation from Utah was as large as that from Nebraska. Governor Holcombe's address of welcome was responded to by Ex-Governor L. Bradford Prince of New Mexico.

Some of the addresses were as follows: Forestry in the Rocky Mountain Region, Hon. R. Park, of Salt Lake City; The Hawaiian Question, Hon. Hugh Craig, of San Francisco; The Nicaragua Canal, Capt. W. L. Merry, of San Francisco; Statehood for the Territories, Hon. Sidney Clarke, of Oklahoma, and Ex-Governor Prince of New Mexico; Trans-Mississippi Freight Tariffs, Hon. James V. Mahone, of Sioux City, Iowa, and Capt. Lon Bryson, of Davenport, Iowa; Cultivation and Uses of Ramie, Prof. Sylvester Waterhouse, of Washington University, St. Louis; Deep Water-ways, Hon. A. P. McGuirk, of Davenport, Iowa; Irrigation, Ex-Governor Prince and others.

The Congress declared for the free coinage of silver. Resolutions were also adopted in favor of government control of the Nicaraguan Canal, indorsement of ramie, appointment of United States irrigation commissioners, admission of New Mexico to Statehood, improvement of Mississippi and Missouri rivers, enactment of a National bankruptcy law, annexation of Hawaii and Cuba, construction of a railway from southern California to Salt Lake, speedy completion of the Hennepin Canal and favoring the deepening of Duluth harbor.

It was also resolved that the United States Congress be asked to take such steps as may be necessary to hold a Trans-Mississippi Exposition in Omaha during the months of August, September and October in 1898, and that the representatives of such States and Territories in this Congress be requested to favor such an appropriation as is usual in such cases to assist in carrying out this enterprise.

A resolution urging the various State governments to take legislative action relative to irrigation was submitted and

passed.

Also a resolution urging the speedy construction of the proposed railroad from

Butte, Mont., via Boise, Idaho, to the Pacific coast. This will shorten the route to Duluth, at the head of the great lakes, from the coast 250 miles and from points in Idaho proportionately, giving the advantages of a part water and cheap freight route to the markets of the East.

Salt Lake was selected as the place for

the next meeting.

DECISION ON COMING WRIGHT LAW.

Decision of the case under the Wright Law in California is soon due from the United States Supreme Court. The hearing was set for the first Monday in January, the 6th. There is general interest in this decision in the West, as it will have a bearing on the acts in all the States. Of the recent decision in Nebraska, the Omaha Bee says: "The importance of the decision handed down last week by the Supreme Court of Nebraska, affirming the validity of the irrigation act passed by the last Legislature is probably not fully appreciated by the people of the State. The court declared the act to be constitutional, and inasmuch as the Nebraska law is essentially the same as that of California, whose law was judicially declared by State courts to be unconstitutional, the decision of our highest court is of great interest. Of course the question may be taken to the federal courts, but the probabilities are in favor of the decision being sustained."

ILLINOIS STATE HORTICUL-TURAL SOCIETY.

THE recent meeting of the Illinois State Horticultural Society at Kankakee The address of President was a full one. T. E. Goodrich, of Cobden, was a resume of horticultural progress during the year. The reports of the treasurer and secretary showed the expenses of the society for the year to have been \$4,280.60.

The committees were as follows: Herrick's essays, L. R. Bryant, H. Augustine, R. T. Fry; final resolutions, J. L. Hartwell, E. G. Mendenhall, G. J. Foster; treasurer's report, J. W. Staunton, George A. Bell, L. F. Small; fruit committees, central, E. A. Riehl, J. N. Fitch, J. I. McSpadden; northern, C. G. Winn, Archie Augustine, G. W. McCluer; southern, J. V. Cotta, L. R. Bryant, O. W. Barnard; general collections, A. L. Small, S. W. Gilbert (of Missouri), C. H. Webster; vegetables, D. S. McKinstry, A. Hamilton (of Michigan).

Interesting and instructive papers were read by C. G. Winn and L. R. Bryant,

and discussed by the members.

During the session one hundred members of the society, with their wives, accepted the invitation of Dr. Clarke Gapen, the superintendent, and visited the irrigated farm of the Illinois Eastern Hospital for the Insane, and also the hospital.

J. N. Fitch, of Cobden, read a paper on cherry, peach and plum culture. W. S. Perrine, of Centralia, presented a revised fruit list for Southern Illinois. Prof. S. A. Forbes, of Champaign, State Entomologist, spoke upon recent progress in agricultural entomology. William Gould, of Villa Ridge, read a paper on the varieties. and cultivation of grapes.

About \$400 was distributed among the successful exhibitors of apples, pears and grapes. E. A. Riehl, of Alton, made a report on work in the experiment stations, which was most favorable to them. G. J. Foster, of Bloomington, presented a revised fruit list for Central Illinois.

In a general discussion as to whether the spraying of fruit trees was beneficial, a majority thought it was. H. L. Doane, of Johnsonville, read a paper on the varieties and cultivation of small fruits. Eugene Davenport, of the University of Illinois, made an address on the use of home-made fertilizers, with especial reference to green manure. G. W. McCluer, of Champaign, assistant superintendent of the State Experiment Station, read a paper on the benefits to be derived from thorough and clean cultivation.

One evening during the session, Dr. Gapen, on invitation, made an able and instructive address on irrigation in Illinois, which was listened to with rapt attention. The doctor gave facts on the simplicity and cheapness of this safe plan of farming which created general surprise and deeply interested his audience in the subject.

Officers elected were: President, T. E. Goodrich, of Cobden; vice-president, L. Small, of Kankakee; secretary, H. M. Dunlap, of Savoy; treasurer, Bryant, of Princeton.

Springfield was chosen as the next place

of meeting.

THE IRRIGATION CAUSE IN NEBRASKA.

THE Nebraska State Irrigation Convention, at Sidney, was largely attended and a pronounced success. There was the greatest enthusiasm in the irrigation cause, and this meeting will give irrigation in Nebraska a great impetus. papers and discussions were of unusual The first resolution was by Mr. interest. W. W. Mason, of Douglas, and favored the holding of the Trans-Mississippi Industrial Exposition in 1898 in Omaha. It was adopted. The report of the Committee on Resolutions on various subjects was adopted, as follows: Establishment of irrigation reservoirs by the Government; the offering of premiums by the State for the wind-mill and other machinery for raising water from wells for irrigation purposes; early adjudication by the Government of matters relative to the waters of inter-state rivers; amending the laws regarding the building of irrigation ditches across Government lands; requesting Senators Thurston and Allen to enter their names in the United States Supreme Court as attorneys in the Wright Irrigation Law case, in behalf of the State of Nebraska; inquiring concerning the expenditures of moneys heretofore appropriated by the Government to advance the cause of irrigation, and calling upon the next Legislature to appropriate money necessary to sink three test artesian wells.

Officers elected were as follows: President, A. G. Wolfenbarger, of Lincoln; secretary, James L. McIntosh, of Sidney; vice-president-at-large, H. E. Babcock, of Ord; treasurer, R. S. Oberfelder, of Sidney; state lecturer, I. A. Fort, of North Platte.

The next annual meeting will be held at Lexington, in October.

HOW TO IRRIGATE IN ILLINOIS.

DR. Clarke Gapen's address before the Illinois Horticultural Society contained many necessary points for new beginners in irrigation in Illinois and the central Western States generally. Extracts are made here and there:

If you had to sell one-fourth or onethird of your land to establish a good irrigation plant, you would be the richer in

the outcome.

A soil to which is given all the water it can use, will produce four times an average product.

With ordinary water irrigation land previously yielding ten bushels of wheat per acre, under irrigation yields sixty bushels per acre; and lands which were worth from \$2 to \$10 per acre increase in value to \$300 per acre.

It makes but little difference what kind of water is used, just so it is wet. It does

not need to be clean water.

Irrigation in the humid regions will undoubtedly be individual rather than cooperative in character. What then are the means by which an individual, or at most two or three individuals, acting together, may secure to themselves an irrigant plant? In a very few cases this may be done by building a dam across a stream and diverting the waters into a channel, which will be carried around on the higher ground and utilized by those owning the land farther down the stream, as is done in Colorado. But, in the main, I take it, irrigation in the humid regions will be used by horticulturists and garden or truck farmers, and in this case only tracts of from ten to forty acres will be irrigated. In these cases the water will have to be raised, probably by some form of pumping machinery.

By means of improved and comparatively inexpensive pumping machinery it is now found possible to deliver water at a very small cost.

The wind-mill would not have a sufficient capacity to deliver the amount of water needed if the water was wholly used during the time the pumping was going on. A reservoir with a capacity of several million gallons may be constructed at a comparatively small expense, and into this reservoir the wind-mill pumps throughout the year, filling it up and affording a supply which will be drawn off during the irrigation season.

Probably, however, the most economical method of delivering water is by means of the centrifugal pump. This pump will raise water to a height not exceeding 50 feet, at a cost not to exceed 20 to 30 cents per million gallons.

Piping for the pumping of water is not

costly.

While, as I have before intimated, it is in horticultural and truck gardening that the best usefulness of irrigation is to be found in this region, yet any crop may be largely increased by irrigation.

A PLANT IN WISCONSIN.

THAT Wisconsin is going into irrigation is evident from the following description of a new plant near Madison owned by Mr. George Raynor, of the Madison Democrat. That gentleman

writes to The Irrigation Age:

"I am laying 3,300 feet of six-inch standard cast-iron water pipe to reach the three high points of a 100-acre farm adjoining Madison and on the shore of Lake Mendota. I will place at the lake a 25 horse power gasoline engine and rotary pump. The plant as it is now being put in will cost \$2,000 or \$20 per acre. About one-fourth of the water will have to be lifted 100 feet, and three fourths about 60 feet. I expect to raise 30,000 gallons per hour and hope that the rains will supply the land until July and that after that two irrigations of four-acre inches each will answer. I expect to put the eight-acre inches on the entire 100 acres at a cost of \$2 per acre annually for fuel and one man to attend engine and distribute water. To this will be say six per cent on the \$20 per acre, making in all nearly \$3.25 per acre annually. crops will be timothy, clover (I will also try four acres of alfalfa this year), apples, of which there are now 250 bearing trees, a few plums, cherries, grapes, potatoes, cabbages and other garden truck. I believe there is not any as extensive irrigation scheme as I am at work on to be found in this state. The advantages I have are: First, abundance of the very best water; second, the very best drainage; third, rather easy distribution of water when once raised to the three high points. The one great disadvantage is the extreme mechanical lift of from 60 to 100 feet."

INDIANA, OHIO, MICHIGAN, MINNESOTA AND IOWA CONVINCED.

In Indiana and Ohio several artesian wells are being sunk. At the recent meeting of the Michigan Horticultural Society the operations of the experiment station in that State in irrigating garden truck were described. The yield was six-fold

greater. Members also testified to the great success of irrigation in their orchards the past season. Minnesota has caught the "well fever" from South Dakota, and numerous wells are being sunk. There is a general movement for dams and artificial lakes or reservoirs. Iowa is sinking wells, but the irrigating canals will also obtain in that State. One extensive enterprise has already been commenced upon, known as the Iowa Irrigating Ditch Company. The incorporators are A. A. Newkirk, Clover Sickler, Wilson Marsh, Charles A. Bryam and Frederick Marsh, who are South Dakota and Iowa men. They propose to operate an irrigating canal and will construct immense reservoirs in which to store surplus water during the winter and early spring. Survey work on the canal has just been completed.

Wisconsin cranberry growers are all

going into irrigation.

KANSAS PUSHING AHEAD.

Kansas development made great progress during 1895, and her people have seen to it that the fact was put on record. The demonstration at Music Hall in Chicago just as the great display at Battery D was about closing was a telling stroke. The speeches of Governor Morrill and Mr. Burton were fully reported in all the Chicago papers, and a good notice was sent broadcast through the Associated Press dispatches. That the United States and Europe know all about Kansas prospects there can be no sort of doubt. W. C. Edwards, secretary of state, projected the Music Hall meeting and raised the necessary funds. Among those on the stage were J. S. Emery, E. R. Moses, L. F. Frizell, E. G. Hudson, E. Stanley, J. V. Beekman and E. Wilder. Mr. Ingalls was to have been the principal orator but his trains failed to connect.

THE RUSH OF EVENTS.

A large project is on foot in the Platte valley, in Colorado, involving the construction of a storage reservoir covering something like 8,000 acres, holding water sufficient to water over 100,000 acres of land

Adjudication is in progress respecting the rights of priority on the Laramie River and its tributaries in Colorado.

In the valley of the Cache a la Poudre

the reservoirs enter the winter nearly all supplied with water to their full capacity, or as much as the managers think is advisable to attempt to carry through the winter. This is better than ever before, due partly to the larger rainfall of the past year.

The return of waters which have been once applied in irrigation has become an important source of water supply in the irrigated districts of Colorado where irrigation has been carried on for some years. The most careful investigation of these has been made on the Cache a la Poudre and on the Platte rivers, the investigations having been carried on now for nearly ten years, principally under the direction of Professor Carpenter of the State Agricultural College of Colorado at Fort Collins. The last measurement, made a few weeks since by Professor Carpenter and by Mr. Preston, of the State Engineers' office, shows large gains over previous years. The Experiment Station of Colorado will soon publish a bulletin by Professor Carpenter on the subject, giving the results of the last ten years of measurement, with the conclusions formed by the present knowledge of the subject.

The researches in irrigation of Professor L. G. Carpenter of the Colorado Agricultural College of Colorado have been recognized by the Government of France by giving him the decoration of Chevalier du Merite Agricole, "for distinguished services to agriculture." This is one of the first, if not the first time the decoration has been conferred on a foreigner.

Secretary Hoke Smith is savagely taken to task for refusing to open the Uncompandere Indian reservation, in Utah, in compliance with the act of Congress. Rich mineral deposits have been discovered.

Much importance is attached to the fact that Australian salt bush flourishes on alkali lands. It is urged that the millions of acres of alkali lands in the West can be transformed into dairy pasturage.

The Culbertson (Neb.,) Era exclaims: "Darn the gold mines. If each Nebraska county which claims to have found one had only discovered an artesian well instead, every patriotic citizen would shout hosannas."

The work of surveying and subdividing the Indian Territory is shown to be progressing rapidly in a report made by the geological survey. The total amount of land surveyed during the last month was 1,500 miles. There are also 493 square miles reported as topographically mapped out during that period.

Farmers in fourteen Western States are in luck. The government weather bureau has organized these States into districts, so that farmers will be warned by telephone, telegraph and signal at least twenty-four hours in advance of blizzards.

ARIZONA.

Canaigre is being shipped from Phœnix to Liverpool, England.

The Arizona Improvement Company sold their Salt River valley oranges to a Chicago firm at \$7.00 per box.

The Gila valley is fast coming to the front. The large alfalfa fields and orchards and the comfortable homes at Thatcher, Layton, Safford and Pima indicate the prosperity of the people.

Some of the Montana buyers are in Arizona already picking up cattle for delivery next spring; 1896 is going to be a better season for the cattle trade.

The report that Judge A. C. Baker had ruled that Pima Indians are by treaty citizens of the United States has proved erroneous.

The cultivated portions of Arizona are worked almost entirely by irrigation. In the mountains are a few tracts where something is raised on the rainfall.

Deer Creek coal fields are found to be very rich and the benefits that would arise from the opening of these fields and the erection of coke ovens at the mines would be almost incalculable. It would give a great boom to mining and smelting for one hundred miles around, and would be of especial advantage to Globe.

The Interior Department has commenced the work of allotting lands to Indians in severalty and the matter is in the hands of C. N. Bennett, the private secretary of Secretary Hoke Smith. Mr. Bennett is now in Phœnix and will commence the division of the Gila Bond, Pima and Maricopa Indian reservations into ten-acre tracts. The land is of good quality and can be

irrigated. The great Sacaton reservation on the Salt and Gila rivers will not be allotted.

Governor Hughes describes the situation as follows: "The statistics of last year show Arizona to be enjoying more than average prosperity. We have more than five hundred thousand acres under cultivation. We have reservoirs and canals under construction which will add more than half a million more within the next two or three years. Our exports in value last year reached nearly fifteen million dollars of products of mines, farms and range. I believe this output will be doubled during the present year."

CALIFORNIA.

California alone has, up to date, produced \$1,350,000,000 in gold. Africa's total product has been \$118,000,000.

Calaveras county, which had never reached the top of the ladder since the discovery of gold, has jumped to the first place as the greatest gold producer in the State, owing to the fact that its aggregate output in gold in 1894 was \$2,124,548. Thus it increased \$464,356 over 1893 and \$1,375,017 over 1892. The total production of gold from 1880 to 1894, inclusive, was \$11,647,495.

Irrigation has made great progress in California during 1895, and still the work goes on. A favorable decision from the United States Supreme Court on the Wright Law is expected during the present month.

A new incorporation is the Sierra Development Company, at Sansalito, \$250,000, with \$2,500 paid in, to build dams, reservoirs, ditches, etc., for irrigation.

West Side Suburban Water Company, at Los Angeles, \$2,000,000, with \$7,000 paid in; to build dams, ditches, canals, etc., for irrigation.

Pacific Water Company, at Kings City, \$300,000, with \$200,000 paid in; William E. Ward, Benjamin S. Coppock, H. V. Morehouse, A. L. Burbank, San Jose.

The Corina Land & Water Company has been incorporated. Capital, all paid in, \$25,000.

The South Tule Independent Ditch Company has been organized. Capital stock, \$24,000.

Squaw Lake Water & Mining Company, \$1,152,000, all paid in, to construct ditches, tunnels, etc., for irrigation purposes. The incorporators are San Francisco and Portland (Ore.) men.

Paladale Town Company, at Los Angeles, \$100,000 with full amount paid in; to build ditches, canals, reservoirs, etc., for irrigation purposes.

Patents have just been issued as follows: 550,710; irrigation headgate; to James M. Eads, San Bernardino, Cal. 550,711; irrigation headgate to same inventor. 548,779; irrigation hydrant; to George A. Doyle, Perris, Cal.

Mexican Water Pipe Company, at Los Angeles, capital, \$500,000; directors, W. L. Carter, O. C. Hinman, John T. Gaffey, M. J. Nolan, G. A. Smith, Los Angeles.

Southern California Improvement Company, at Los Angeles, capital, \$500,000; directors, Bruce E. Ritchie, Hinsdale, Ill.; J. M. Stewart, Chicago; W. E. Robinson, C. E. Crowley, John Love, Los Angeles.

Final surveys are being made for the San Lorenzo Water Company's proposed irrigation system at King City, Monterey county. The height of the dam will be 100 feet, and will impound sufficient water to irrigate about 15,000 acres of level and fertile land in the vicinity.

Southern California Mountain Water Company, at San Diego, \$3,500,000, with full amount paid in. This company succeeds the Mountain Tecarte Company in constructing the irrigation system of that company, which includes four large dams, and is calculated to irrigate most of San Diego county south of the San Diego river and west of the main range.

California is now competing largely with France and Italy for the dried fruit and canned fruit trade of Mexico.

The 27th anniversary of the founding of the Patrons of Husbandry was celebrated at Stockton on the 7th of December.

The Los Aguilas ranch, consisting of 23,650 acres, in San Benito county, was knocked down to Andrew B. McCreery for \$80,000.

It is a fact that California is knocking out Baltimore and Maryland in the canned goods industry of the United States.

Over 40,000 40-pound sacks of peanuts were raised in Orange county the past

season, and the price realized from the crop was from $3\frac{1}{2}$ to 4 cents a pound.

California the past year has produced and packed enough prunes to give every boarder in the United States just four pounds.

Claus Spreckels, the sugar King, says he will invest \$1,000,000 in three new beet sugar factories in California.

There is a prospect of a beet sugar factory at Anaheim in the near future, an Eastern syndicate having taken hold of the proposition in earnest.

The San Bernardino, Arrowhead & Waterman railway, and the Harlem Springs resort are both about to be sold, and everything points to F. Kohl, of Centralia, Ill., as the purchaser.

A Perris rancher reports a second crop of ripe peaches during 1895. The fruit was not so large as the first crop, but was well matured and of fine flavor.

In one week San Jose shipped East 551,670 pounds of canned fruit, 1,014,925 pounds of green fruit, 4,026,285 pounds of dried fruit, 107,280 pounds of wine, and 170,850 pounds of garden seed.

P. W. Morse, of the Watsonville Beet Sugar Factory, announces that there will be no reduction in the prices paid for beets by his company next season. A straight price of \$4.00 per ton, irrespective of sugar content, will be paid.

Another industry is about to be developed in Southern California. The first cargo of guano ever taken from the Channel islands, off Santa Barbara, was brought into that place recently.

The Antelope Valley Association is the name of a strong organization just completed and composed of all those who are interested in the welfare of Antelope valley and are willing to work for its progress. It will work for the whole valley as the Los Angeles Chamber of Commerce acts for Southern California.

The newspapers are urging the organization of fruit growers, so that the profits of middlemen may go to the producers. Small farms and diversified crops are also advocated. The Irrigation Age is well read throughout the State.

COLORADO.

The mining improvement is not local to Cripple Creek. The whole State is involved.

Taking the State as a whole, the increase of population can not be less than 300 daily, or at the rate of 100,000 a year.

Notwithstanding the mining excitement, agricultural lands are selling and irrigation enterprises are being pushed forward.

The good effects of the remarkable mining development in Colorado are directly apparent in the increased State revenues.

The railroads are reaping a harvest, and the officials are in a happy frame of mind

W. S. Stratton, the luckiest single mine owner at Cripple Creek, is arranging for the erection of a large electrolytic reduction works, either at Cripple Creek or Colorado City.

It has been discovered that almost ninetenths of the West Creek district, one of the new gold fields, is in a United States timber reservation, and persons working there are liable to imprisonment for trespass.

From the Gilpin district \$75,000,000 has been taken during the past thirty years, and the product averages \$2,500,000 a year.

The Leadville district is yielding heavily of gold, but generally mined from deep levels. Depth in all districts shows no signs of exhaustion. In the Gilpin district some of the mines are down 2,200 feet. There are scores of producing districts in the State.

It is not to be understood that all of the 600 companies organized and claiming ownership of properties in the district of less than thirty square miles are dividend-payers. Of 125 of these companies that are considered worthy of note, in the stock of which there has been more or less trading, only nine are reported as dividend-payers, thirty-two are producing, fifty have some ore in sight (generally of too low a grade to ship), and thirty-four own prospects that they are about to develop.

Of a monthly production now amounting to fully \$1,000,000, the greater portion comes from those classed as producing mines, and the proceeds are generally reinvested or are used in operating expenses.

The estimated Colorado products for

the year 1895 including the mining, agricultural, and manufacturing, was over \$100,000,000.

Carver Remington, of the Remington Typewriter Company, Chicago, has been elected vice-president of the new Mining Exchange at Cripple Creek.

Sales at Colorado Springs on Tuesday, December 24,aggregated 1,000,000 shares.

In his contest for the ownership of the Plymouth Rock mine, W. S. Stratton, the Bonanza King, has been successful, defeating D. H. Moffat.

IDAHO.

For a place where "no great rush is anticipated" the Nez Perces reservation is receiving its fair share of attention. The best of it is that most of the homesteaders will be actual settlers, not speculators, and next season the land will be covered by growing crops to tempt the railway builders on to Central Idaho.

Since the discovery of gold in 1860, Idaho's mines have annually produced about \$6,000,000 worth of precious metals. In 1890 the mineral output of the State was \$14,000,000.

The lands of Idaho are classified as follows: Grazing, 25,000,000 acres; agricultural, 15,000,000; timber 7,000; lakes and rivers, 1,000,000 acres. To those must be added several million acres of mineral and mountainous lands.

The United States Government has made an agreement with the Bannock Indians to build an irrigation canal fifty miles long in the Bannock reservation for irrigating about 150,000 acres, the water to be taken from Snake river.

The Washoe Irrigation & Power Company has been incorporated, \$20,000 to construct a canal in Canyon county, taking water from the Payette river, for irrigating the lands in the Washoe bottom.

The commissioner of Indian affairs is about to make another effort to have the Fort Hall, Idaho, reservation irrigated, so that it may be of some use to the Indians as farm lands.

KANSAS.

There is general satisfaction throughout the State over the exhibition train of the Kansas Million Club, the display in Battery D, at Chicago, and the concluding grand mass meeting at Central Music Hall. The good work of attracting immigration to the State will be energetically continued. Irrigation is all the rage, and it has proved most wonderfully successful. The number of irrigators in 1895 was 1,638.

D. M. Frost, president of the Kansas Irrigation Board, from ten acres in Finney county produced the past season two and one-half tons of sugar beets, 200 bushels of tomatoes and 1,036 bushels of sweet potatoes.

The fruit growers of Wyandotte county now have upwards of 20,000 barrels of applies in cold storage. This is an experiment, and if successful hereafter apples will be stored in the fall instead of shipped, giving the growers instead of the speculators the benefit of the advance in price.

Leading creamery managers of Kansas have formed what is known as the Kansas Creamery and Supply Company, including nearly all the creameries of the State, and will make united effort to secure the market of the South.

Capt. W. S. Tough, formerly United States Marshal for Kansas, and who has for so many years managed the Kansas City stock yards horse and mule market, is to deliver an address before the annual meeting of the Kansas Board of Agriculture, on "The Horse Situation and its Future Outlook."

Many of the larger farmers, who can afford it, have cribbed their corn and are holding for better prices. Many more, however, have sold out at 15 to 17 cents per bushel.

W. C. McClain, of Huron, cashier of the State bank of his town, built cribs large enough to hold 15,000 bushels of corn.

George M. Munger has an irrigating plant located at his Catalpa Knob fruit farm, seven miles south of Eureka, in Greenwood county. The water supply is furnished by an artificial pond, which with the dam now constructed, will cover about 100 acres.

A coal mine has been opened up on the farm of John Hulsey, near Port Williams, and people in that vicinity will burn coal to a certain extent this winter.

The twenty-ninth annual meeting of the Kansas State Horticultural Society was held at Lawrence. It had a big attendance and was a success in every way. The papers were interesting and instructive.

It is understood that the Standard Oil Company has acquired almost undisputed possession of the Kansas oil fields.

The commissioners of Shawnee county have decided to build a bridge across the Kaw river into Topeka. It will cost \$150,000.

Among the new topics introduced at the meeting of the Kansas Dairy Association was that of Pasteurizing milk and cream, and the process is finding considerable favor in other States, according to the reports.

The Rock Island is putting in a dam at Phillipsburg and next will put one in at Smith Center. The latter will cause an extensive lake to form.

Martin Mohler has taken a fancy to English Berkshires. He will raise no more wheat. Instead he will plant Kaffir corn, sorghum and other forage crops for hog feed.

The Kansas corn crop for 1895 is about 201,457,496 bushels.

N. H. Stidger is the father of irrigation in Ness county, says the Ness County News. He urges that it will pay any man to irrigate a garden spot, if he has to pump water by hand.

O. P. Updegraff, secretary of the Kansas State Swine Breeders' Association, says: "The foundation swine stock in our State has already given us a great reputation, and careful attention to our business will put millions of dollars in our pockets. Let us put forth a grand effort to further the interests of our association. It's like that household necessity, the baby buggy—'a good thing, push it along.'"

The farmers of Stanton county were never in as good shape financially as now. The past has been a year of plenty with them.

In 1894 Kansas had 90,825 acres in alfalfa, and in 1895, according to official returns, very close to 125,000, which is an increase of 38 per cent.

The Osage Carbon Company's pay roll on Saturdays is \$20,453.29. They also pay \$869 to the Scandinavian Company. At Scranton their pay roll is \$6,889.73.

Finney county farmers are paying their taxes promptly. Irrigation did the business.

Stafford county farmers have discovered that a profitable crop for them is celery.

Fourteen extra fine spring pigs raised in Chautauqua county weighed 4,280 pounds.

Liberal is becoming noted as a health resort.

MONTANA.

"It is only during the last two or three years that the people of Montana have turned their attention to gold mining, and this period has been characterized with discoveries and developments of gold belts which, judging from their immensity and richness, will eventually place Montana at the head of gold-producers, as well as that of copper." This is the claim of the State press.

The most important recent mining deal in Western Montana was that which occurred in Deer Lodge, whereby W. A. Clark became the owner of Willard Bennett's interest in the Royal Gold, which is one of Granite county's biggest gold-producers. The transfer includes all of Mr. Bennett's stock, consisting of 120,000 shares, at a price of about \$1 per share.

A batch of thirty-one patents for settlers on homesteads within the Helena land district was received at the land office in one week.

It is a fact not generally known that Butte produces 2,000,000 tons of copper ore annually.

The Helena mineral land commissioners have examined and classified 216,600 acres of land, and but one protest has been filed in the local land office.

Deeds transferring the site of the State School of Mines, which will be built in Butte, have been recorded, and the necessary buildings will be constructed in the spring.

The Belt and Sand Coulee coal mines of Cascade county now produce nearly 5,000 tons of coal a day. The pay rolls of these two companies aggregate \$125,000 every month.

The Last Chance Ditch Company at Joliet, Carbon county, has been incorporated; \$5,000; Andrew Nerlin.

The crop statistics of Gallatin county

average as follows: Wheat, 40¼ bushels; hard wheat, 34 bushels; oats, 57.96 bushels; hay, 1.48 tons; barley, 47.24 bushels; peas, 23 bushels; potatoes, 247.8 bushels.

NEBRASKA.

The favorable decision of the Supreme Court establishing the validity of the district irrigation law will have an astonishing effect in reviving agriculture and commerce in Nebraska. Thousands of acres of semi-arid lands will at once be reclaimed and rendered as fruitful and productive as the most favored agricultural regions in any part of the United States, and the assurance of the crops in the irrigated portions will be made a matter of certainty so that the owners of these lands will be able to sow and reap regardless of rains or hot winds.

A proposition submitted to the Lincoln and Dawson county irrigation district, comprising 40,000 acres of laud lying on the north side of the Platte river in Lincoln and Dawson counties, to vote 6 per cent bonds to the amount of \$275,000 was carried by a majority of 84 to 18. The canal will be 62 miles long, with 115 miles of laterals and will be 100 feet wide at its head.

In Western Nebraska there are several windmill plants from each of which thirty to forty acres of ground are irrigated. It seems that irrigation by windmills has made very rapid strides in Nebraska during 1895.

The construction of an irrigation ditch in Holt county is proposed. The ditch is to draw water from the Niobrara and Snake rivers in Cherry county.

The artesian well drilled for S. W. Davis on his farm in the Ponca valley is completed. The depth is 770 feet and water bearing rock 25 feet thick was drilled through. A gusher was struck that flows 6,000 gallons of water an hour through a three-inch pipe and has a pressure of 30 pounds to the square inch, throwing a stream 30 feet into the air.

The owners of the gold-bearing lands in the vicinity of Milford are going steadily ahead with projects for developing their properties, and in a few weeks it will be definitely known what the prospects are for making Nebraska a gold-producing state. Prof. Herbert Bartlett compares the formation and quality at

Milford with that of South America, Australia and other gold fields explored by himself.

A correspondent at McCool Junction writes: "While it is believed that gold can be found here in the valley of the Blue, the flowing wells are considered by farmers as of much more value than the prospective wealth of the gold fields. The flowing wells are being found near Two wells have been located in this county and a number of farmers near here are going to bore for the artesian One thing is peculiar about this artesian flow. Men using common well augers bore down to a depth of eighty to 125 feet and an abundance of water gushes up about three to six feet above the surface."

State Engineer Howell and secretaries Akers and Bacon of the state board of irrigation are preparing to adjudicate 181 cases involving claims for water in the Republican river watershed. Twelve of the cases also involve contests for water rights, but Engineer Howell believes that he can dispose of the entire lot by the middle of the present month.

This is the truthful way the Culbertson Era puts it: "Alfalfa vs. the Mortgage. They will never stay long on the same farm. Incompatability of their temper. If the alfalfa stays, the mortgage must go."

The trouble between the sugar beet growers and the factory people at Norfolk, growing out of the refusal of the factory to accept the beets under the contract, has culminated in a big law suit against the company. This will undoubtedly throw more light upon the question as to the correctness of the findings of the company's chemists in tests reported.

Last month's disbursements at the Table Rock creamery amounted to \$16,537.

Ten thousand fish have been distributed in Cheyenne county by the state commission.

Fred Smith, a Buffalo county farmer near Ravenna, raised thirty-five acres of sugar cane and is now making sorghum at the rate of 100 gallons per day. He will have 2,000 gallons, which will net him \$800.

At the recent meeting of the inter-state association of state fair managers at Chi-

cago Ex-Governor Furnas of Nebraska was re-elected president of the association.

Dr. W. H. H. Dunn, who farms near Lincoln, has found hemp a very profitable crop.

Northwestern Nebraska is ong on hay and short on cattle. There should by rights be thousands of young cattle up in that country. But the fact is that the whole country is short on cattle.

Nothing could be more directly in line with the demands of the hour than extensive cold storage facilities at some central point, as Omaha, for instance, for caring for the dairy and fruit products of Nebraska and Iowa.

"Alfalfa is all right and so are sugar beets," says Peter Youngers, of Geneva, "but as for me I propose to stand by the sub-soil plow through thick and thin."

NEW MEXICO.

The Marguerite Canal Company has bought the Pioneer canal at Barstow.

A large tract of land, of about 2,100 acres on the lower Mimbres near Deming, was sold recently by Mr. Spaulding to a stock company organized in New York. It is the purpose of the company to turn this vast area of land into a canaigre farm.

The building of the El Paso, Chicago & Mexican railway will be commenced some time during the latter part of this month.

Papers have been filed with the secretary of state incorporating the Albuquerque, Colorado & Pacific railroad, capitalized at \$100,000.

It is believed that the Wichita reservation will soon be open to settlement.

The sugar beet factory in the Pecos valley seems to be assured.

NORTH DAKOTA.

There is the same opportunity in this State to irrigate by means of artesian wells that there is in South Dakota, and numerous contracts are being let for the sinking of wells.

The Grand Forks Plaindealer says there is enough fuel beneath the soil of North Dakota to furnish heat for the entire nation for years.

Bismarck business men are agitating the question of building a railroad for twenty miles north of that city to the coal fields. Experts estimate that a section of land containing the coal will produce 5,849,088 tons.

The Sherbrooke Tribune is authority for the statement that Hon. J. O. Smith had 750 acres of flax on his Plainview farm in Newburgh township the past season from which he gets over 12,000 bushels of flax.

OKLAHOMA.

One of the largest and most representative conventions ever held in the Territory in favor of Statehood has just adjourned. The population now is 275,000.

Taxable property in Oklahoma increased from \$19,947,922.86 in 1894 to \$39,275,-189.21 in 1895.

Secretary Lowe, of Oklahoma Territory, has issued a charter to the Santa Fe, Oklahoma & Western Railroad Company, which also includes a land and town site company, capital stock being fixed at \$1,500,000.

The value of alfalfa for Oklahoma is emphasized by the behavior of the crop at the agricultural experiment station.

Canadian county land is quoted as more valuable than that of any other county in Oklahoma.

The report respecting the leasing of school, college and public building lands in Oklahoma is very satisfactory, and shows the net proceeds for the year 1895 to have been \$88,627.97.

The governor asks that all the public lands in the Territory, not filed on at this time, be donated to the Territory for the use and benefit of public schools.

OREGON.

A rich discovery of gold quartz is reported from Baker City. The discovery was made by George McCarty in the Virtue district at a depth of 20 feet. The ledge is five feet wide, the ore showing gold in large quantities.

The American Bar Company, at Klamath river, near Ashcreek, has taken out considerable gold this season, realizing as high as \$200 per day in some clean-ups.

The secretary of the Oregon Board of Horticulture estimates that there are 565,000 acres of pit and core fruit in the State, and 541,500 acres of a berry variety. There are stored

35,000 acres set to prunes, the estimated yield being from 80,000 to 100,000 pounds dried, in one orchard of twenty-three acres.

It is reported that the Bellevue mine has been disposed of to the Standard Oil Company for \$210,000.

A colony of fifty people from Scotland will locate in Grand Ronde valley.

Many tons of chittim-wood bark are shipped weekly from Halsey to San Francisco to be made into bitters.

Oregon produced 80,000 bales of hops the past season. If weather had been better, and prices had warranted it. the yield would have reached 110,000 bales.

The total amount of wool in the grease scoured by the Pendleton scouring mill the past season was 2,171,504 pounds. The amount of clean wool from this was 566,-252 pounds.

SOUTH DAKOTA.

Farmers have been greatly encouraged by the prospects of irrigation from artesian wells, and are not nearly so anxious to sell out as they were early in the fall. Artesian wells are being bored in large numbers, and an abundant flow of water is invariably found at a depth of from 250 to 300 feet. Irrigation will be tried on an extensive scale during 1896.

Work is progressing rapidly on the Steimer & Shrader artesian wells. Brule county will probably have a dozen new artesian wells by spring, and quite a number of irrigated farms next season.

Oschner Bros, of Kimball, say the outfit is now being placed in position for the commencement of drilling on the artesian well.

Judge G. H. Carroll, of Miller, is an enthusiastic advocate of irrigation.

Frank Morris of Tripp is selling irrigated land.

A. E. Swan, of Swan Bros., of Andover has gone to Forest City to make arrange ments for sinking an artesian well for the government at the Indian agency.

An exhibition train bearing products from the big irrigation farm near Mellette, and from others in the State, is making a winter tour of the East and South.

The actual cost of irrigation in South Dakota is fifty cents per acre.

A report from Mellette says that F. R.

Ryerson, of Spencer, Iowa, has purchased W. W. Taylor's interest in the famous Hunter irrigation farm.

Johnson and Mahanna have completed the six-inch artesian well on the county poor farm, one and a half miles from Pukwana, and it is one of the finest wells in the county. It is 925 feet deep and throws a stream of water, clear as a crystal, forty-one inches above the pipe.

TEXAS.

John Willacy, of Portland, has filed with the County Clerk of San Patricio county, statements and estimates for the construction of two enormous dams across the Nueces river, one twelve miles and the other twenty miles from Portland. It is proposed to construct a canal from the first dam to Portland. The same will be under the control and management of the Nueces Bay and Irrigation Company. The upper dam will be operated by the Nueces Valley and Irrigation Canal Company. It also will consist of a canal of about eight miles in length between the upper and lower dams. As these dams will never fail to fill less than four times a year (owing to the enormous territory that the Nueces river drains) it will be easily understood that a very large body of land can be irrigated therefrom.

Laredo is to have in the near future one of the biggest irrigation industries in existence. Captain Wm. Anderson has at last succeeded in enlisting capitalists in New York and Chicago in the enterprise. Mr. R. Walker, who has been operating the coal mines under a lease, sold out his entire interest to these people, they paying him \$11,000 for his unexpired lease. The new organization has arranged to purchase the entire Santo Tomas tract, consisting of 43,000 acres of rich coal fields. Preparations for irrigating these lands in connection with mining are now being made.

Another big Texas irrigation project has been formed in Maverick county, looking to the construction of a canal leading out from the north bank of the Rio Grande, some thirty miles above Eagle Pass, and extending down the river for twenty-five miles.

The San Antonio Irrigation Co. has been incorporated to build a canal 25

miles long and 14 feet wide to irrigate 25,000 acres of land; Z. O. Stocker, San Antonio; J. S. Taylor, Laredo, Tex.

UTAH.

The Pioneer Electric Power Company, of Ogden, has commenced the construction of its irrigation canal, lying west and northwest of Ogden and on the north side of the Weber river. The canal will have a capacity of 120 cubic feet per second, and is intended for the irrigation of 18,000 acres of land.

Two companies are clawing at each other in the effort to first acquire possession of rights on the Gooseberry reservoir and irrigation scheme near Mt. Pleasant, Utah, a new Richmond, with a surveying corps, having lately appeared upon the scene. This reservoir scheme is, with the exception of the Bear River Irrigation Company's, the largest and most important in Utah, and will involve an outlay of a capital of \$500,000.

Henry M. Ryan, representing a company of Chicago capitalists, will shortly begin the greatest undertaking ever yet attempted for the development of the mines in the Camp Floyd district—that is, a thorough prospecting of the district by means of diamond and churn drills.

WASHINGTON.

A very large irrigation project is talked of in the State of Washington. The plan is to tap with a main canal the St. Joe river, in Idaho, and carry the water across the fertile portion of eastern Washington to the arid region of the Columbia basin, and reclaim two or three million acres of land which is at present valueless except for scanty grazing.

A Seattle syndicate has shipped to the Everett smelter, from one of a group of mines owned by the syndicate, a carload of ore which turned out a value of \$70.96 per ton in gold, silver and lead. The vein was discovered early in August and has been traced on the surface for more than 1,400 feet. The mines are located eight miles from Skykomish Station on the Great Northern.

Spokane is feeling the good effects of the revival of mining in the Trail Creek and other districts. During the past year over \$250,000 has been paid out in Spokane in dividends, one mine, the War Eagle, alone paying \$132,000. The Le Roi has paid \$25,000, the Slocan Star \$50,000, and the Cariboo claims large amounts.

The great jetty at the mouth of the Columbia is nearing completion. The jetty is one of the most successful works of the kind ever constructed, and the cost has been far within the estimates. There is now a wide, straight channel 30 feet in depth.

An irrigating canal is to be constructed near Walla Walla, which will water 16,000 acres of land.

WYOMING.

Application has been made to the State Engineer at Cheyenne by the Wyoming Irrigation and Land Company for water to irrigate 21,000 acres of land. It intends taking the water from Green river, in Sweetwater county, where this company has secured 48,000 acres of railroad land and has applied for an equal acreage under the Carey act.

A. M. Crafts, the Douglas civil engineer, is in Casper again viewing the territory there, with the intention of carrying successfully his plan of building an irrigating ditch from Bessemer through the hills south of Casper to Glenrock.

A section of country that is attracting more than ordinary attention just now is the Four Mile placers, situated about seventy-five miles south of Rawlins on the Snake river, in Carbon county.

Six thousand five hundred acres of oil lands adjoining the Cudahy tract passed into the hands of C. B. McClenny, of Florida, last week, says the Douglas News.

The Golden Bar Steam Dredging Company intend placing two large steam dredges on the upper Snake river, in Uinta county, for the purpose of working their valuable placer ground, which consists of over 1,000 acres of low bars on both sides of the river.

WASHINGTON, IDAHO, OREGON AND BRITISH COLUMBIA.

The Northwest Fruit Growers' Association held their annual session at Walla Walla, continuing for four days, with extra conclaves in the evening. It was largely attended. Dr. N. G. Blalock, the president, was in the chair, C. A. Tonneson, of Tacoma, acted as secretary.

Hon. H. S. Blandford, in behalf of the citizens of Walla Walla, very cordially welcomed the fruit growers and visitors to the hospitality of the city. were instructive papers and addresses by N. G. Blalock, J. A. Balmer, E. F. Babcock, J. B. Holt, C. L. Whitney, J. M. Hixson, T. R. Coon, C. A. Tonneson, S. A. Clarke, John Hill, Frank Lee, William Brown, H. S. Blandford, F. I. Whitney, J. P. McMinn, Prof. G. A. Droll, Prof. J. M. Bloss (Oregon Agricultural College) and M. P. Carter and J. R. Anderson (British Columbia). vision was made for the establishment of a Bureau of Information, the condition for membership to be actual shippers of fruit of Oregon, Washington, Idaho and British Columbia, and also the applicant to be a member of the Northwest Fruit Growers' Association. The standing committee on Bureau of Information was instructed to take up the matter of exposing dishonest commission merchants. The association elected the following officers for the ensuing year: President, Dr. N. G. Blalock; secretary, C. A. Tonneson, Tacoma; treasurer, W. Offner; vice-president for Oregon, Emile Schanno, The Dalles; vice-president for Washington, R. C. McCroskey, Garfield; vice-president for Idaho, H. A. Russell, Kendrick. The next meeting will be held at North Yakima, the second Tuesday in December, 1896.

BOOKS AND MAGAZINES.

The December Century has a seasonable Christmas article in Edith Cane's paper on Tissot's The Life of Christ, and the first paper on The Passion Play at Vorder Thierese, by Annie S. Peck. The Life of Napoleon is continued. Among the table of contents are Appeals to Lincoln's Clemency; One Way Out, and Humperdinck's Hansel and Gretel.

One of the leading articles in Scribner's for the month is Wild Beasts as They

Live, by Capt. Melliss.

One of the most striking contributions is the opening paper by Cosmo Monkhouse, on Laurens Alma-Tadema, which is fully illustrated with reproductions of the artist's most famous paintings. There are good short stories by Frank R. Stockton, Joel Chandler Harris, Henry Van Dyke, Charles E. Carryl and A. S. Pier.

The December number of McClure's magazine contains a continuation of the Life of Lincoln, with new portraits. McClure's magazine claims to have increased its circulation to the extent of 100,000 since beginning the publication of Lincoln's life. It certainly is one of the most readable magazines issued. Among the other features in this number are: The Sun's Heat, by Sir Robert Ball; Through the Dardanelles, by Cy Warman, and the true story of Annie Laurie.

Lippincott's magazine for December contains, English Medieval Life; Gunning for Gobblers; Orchids; Japanese Sword Lore; Athletic Sports of Ancient Days and

Meets.

The Christmas Cosmopolitan appears with a colored lithographic frontispiece. Among the leading features are: A Christmas Legend of King Arthur's Country; one of Robert Louis Stevenson's stories, A Tragedy of the Great North Rood; Butterflies, by James Lane Allen, and a story called Tonia, by Ouida; Game Fishing in the Pacific, and Actresses who became Heiresses.

The Review of Reviews for December is larger than usual and it is well filled with many important matters. Sherman's Story of his own Career, by E. B. Andrews is interesting. The Venezuelan question is very timely on account of recent developments in the status of affairs between the United States and England. Among the other worthy features are: An Indian on the Problems of his Race, and a character sketch of Herbert Spencer. Dr. Shaw in the Progress of the World carefully reviews existing political situations and important current topics.

The Social Economist of New York, edited by George Gunton, for December contains a number of interesting items, among them are: What Shall be Done With the Tariff; Legal Merits of the Venezuela Case; Woman Labor in Eng-

land, and others.

The Monthly Illustrator and Home and Country for December contains an article of the Life of Christ, which is illustrated with innumerable reproductions of celebrated paintings and drawings. The story of Jean Valjean is concluded in this number. This magazine is rapidly taking its place in the front rank of illustrated publications.

LIST OF IRRIGATION REPORTS.

HE following list gives the titles of the principal reports bearing more or less directly upon irrigation which have been printed at the Government Office at Wash-Some of these are very ington, D. C. elaborate and expensive, being fully illustrated by colored maps and diagrams. Nearly all can be obtained either through members of Congress or by purchase from the Superintendent of Documents of the Department of the Interior, Washington, D. C., at cost of printing; or, these two sources failing, they can be had from dealers in Government publications. These reports have been arranged in chronological order, the full title being accompanied by a brief note as to the contents:

1879

Report on the Lands of the Arid Regions of the United States, with a more detailed account of the lands of Utah, with map, by J. W. Powell. 2d ed., 1879, quarto, 195 pp.

United States Geographical and Geological Survey of the Rocky Mountain region. Contains chapters on water supply and irrigable lands of the Salt Lake drainage system, by G. K. Gilbert; Irrigable lands in the valley of the Sevier River, by Capt. C. E. Dutton; Irrigable lands in that portion of Utah drained by the Colorado River and its tributaries, by A. H. Thompson.

1882

Artesian Wells upon the Great Plains, being the report of a geological commission appointed to examine a portion of the great plains east of the Rocky mountains and report upon the localities deemed most favorable for making experimental borings, by C. A. White and Samuel Aughey. 1882, octavo, 38 pp.

This report is a brief description of the geology of Eastern Colorado and is accompanied by appendices containing details of deep borings at various localities.

Report on the climate and agricultural features and the agricultural practice and needs of the arid regions of the Pacific slope, with notes on Arizona and New Mexico, made under the direction of the Commissioner of Agriculture, by E. W. Hilgard, T. C. Jones, and R. W. Furnas, 1882, octavo, 182 pp.

This pampliet contains papers upon the climates of the Pacific Slope, the Irrigation of the arid region, the soils of the arid region, the effects of alkall, lake and river waters of the great valley and their quality for irrigation purposes, the field crops and animal industries of the Pacific Coast, miscellaneous field culture and other agricultural and horticultural matter, together with a brief description of Arizona and New Mexico.

Report of an examination of the Upper Columbia river and the territory in its vicinity, In September and October, 1881, to determine its navigability and adaptability to steamboat transportation, made under direction of the Commanding General of the Department of the Columbia, By Lieut. Thomas W. Symons, 1882, quarto, 133. pp. 47th Congress. 1st Session, Senate Ex. Doc. No. 186.

This report contains numerous maps and illustrations and describes the Columbia River and its tributaries, as well as the adjacent agricultural areas in Washington.

1887

Irrigation in the United States. A report prepared by Richard J. Hinton, under the direction of the Commissioner of Agriculture. 1887, octavo, 240 pp. 49th Congress, 2d Session, Senate Mis. Doc. No. 15.

This report relates to irrigation in the United States, its extent and methods, with a digest of laws governing water supply, the details being arranged in general by States and Territories.

1888

Report on the interior wheat lands of Oregon and Washington, by Lieut. Frank Greene, 1888, octavo, 25 pp. United States Signal Service.

Letter to the Honorable Secretary of State on the general outline for a proposed scheme for an international dam and water storage in the Rio Grande river near El Paso, Texas, for the control of the annual floods, etc., and preservation of the national boundary to the gulf, and for other purposes.

1889

Annual report of the Commissioner of Agriculture for 1888.

Contains a paper on forest influences, pp. 602-618, by B. E. Fernow.

Report on the Internal Commerce in the United States for the fiscal year 1889, Bureau of Statistics, Treasury Department, 1889, octavo, 697 pp.

Contains description of conditions of agriculture and necessities for irrigation in New Mexico Wyoming and other portions of the West.

Irrigation in Egypt, by J. Barois, Paris, 1887, translated from the French by Major A.M. Miller, Corps of Engineers, U. S. A., 1889, quarto, 111 pp. 50th Congress, 2d Session. House of Representatives, Mis. Doc. No. 134.

This report is illustrated by twenty-two plates and gives detailed information concerning Egypt and the Nile, a description of the irrigation works of Upper and Lower Egypt, methods of elevating and using water, and references to laws and regulations.

Report on rainfall in Washington Territory Oregon, California, Idaho, Nevada, Utah, Arizona, Colorado, Wyoming, New Mexico, Indian Territory and Texas, for from two to forty years, 1889. quarte, 111 pp. 50th Congress, 1st Session, Senate Ex. Doc. No. 91.

This report is illustrated by fifteen maps showing the mean monthly and annual rainfall. It consists of a paper upon the rainfall of the Pacific Slope and the Western States and Territories, by Gen. A.W. Greeley, together with charts and tables of the rainfall on the Pacific Slope with a discussion of the causes of the wet and dry seasons, the abundance and deficiency in different portions, the summer rainy season in Arizona, etc. by L eut. W. A. Glassford.

1890.

The Climate of Oregon and Washington Territory, 1889, quarto, 37 pp. 50th Congress,1st Session, Senate Ex. Doc. No. 282.

This pamphlet consists mainly of tables showing the monthly and annual precipitation and also ther mean monthly and annual temperatures at points in

Oregon and Washington up to 1887. It is illustrated by 7 maps and diagrams.

Report of the Secretary of Agriculture for 1889.

This report contains, pages 297-300, a paper by B. E. Fernow upon the influence of forests on water supplies.

Report of the Secretary of Agriculture for 1890.

This report contains paper, pp. 227-237, by B. E. Fernow, upon artificial raintall.

First Annual Report of the United States Irrigation Survey, 1890, octavo, 123 pp.

This is printed as Part II. Irrigation, of the 10th annual report of the Director of the United States Geological Survey, 1888-89. It contains a statement of the origin of the Irrigation Survey, a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation and report of work done during 1890.

Climate of Nebraska, particularly in reference to the temperature and rainfall and their influence upon the agricultural interests of the State, 5 appendices, and 12 charts, 1890, quarto, 60 pp. 51st Congress, 1st Session, Senate Ex. Doc. No. 115.

This pamphlet consists of a paper upon the climate of Nebraska accompanied by tables giving the monthly and annual precipitation and the mean monthly and annual temperatures.

A report on the preliminary investigation to determine the proper location of artesian wells within the area of the 97th meridian and east of the foothills of the Rocky mountains, 1890, octavo, 398 pp. 51st Congress, 1st Session, Senate Ex. Doc. No. 222.

Consists of a report of the special agent in charge concerning existing artesian wells, accompanied by papers relating to the geology of North and South Dakota, Nebraska, Eastern Colorado, Kansas and Texas. Illustrated by 3 folded maps.

Report of the special committee of the United States Senate on the irrigation and reclamation of arid lands. Report of the committee and views of the minority, 1890, 4 vols., octavo. 51st Congress, 1st Session, Senate Report No. 928.

Report No. 928.

This consists of a majority and minority report accompanied by the testimony in full and documents presented to the committee during its trip through the arid regions. The first volume treats of the Northwest, including South Dakota, North Dakota, Montana, Eastern Washington, Eastern Oregon and Idaho, and contains 469 pp; the second volume covers the Great Bash regions and California, including Utah, Nevada, California and Arizona, and consists of 573 pp.; the third volume relates to the Rocky Mountain region and Great Plains, including El Paso and Lower Rio Grande, New Mexico, the staked plains of Texas, Western Kansas, Colorado, Wyoming, and Eastern Nebraska, containing 608 pp; the founth volume contains statements by Major J. W. Powell and other officers in the United States Geological Survey, reports of the United States Consuls in countries using irrigation, and other papers,

Progress Report on Irrigation in the United States, 1891, octavo, 2 vols., 337 pp., 14 pp. and 10 maps. 51st Congress, 2d Session, Senate Ex. Doc. No. 53.

The first volume contains various papers upon the condition of irrigation in different localities, the climate, wells, and other sources of water supply, irrigation statistics and progress in Colorado, alkali and soil waters in California, and other papers; the second part consists of a description of level lines run across portions of Colorado, Nebraska and Kansas, and is illustrated by profiles showing the depth of water in wells.

Second Annual Report of the United States Irrigation Survey, 1891, octave, 395 pp. This is published as Part II. Irrigation, of the eleventh annual report of the Director of the United States Geological Survey, 1889-90. It contains a description of the hydrography of the arld region and of the engineering operations carried on by the Irrigation survey during 1890, also the statement of the Director of the Geological Survey to the House Committee on Irrigation and other papers, including a bibliography of irrigation literature. It is illustrated by 29 plates and 4 figures.

Third Annual Report of the United States Irrigation Survey, 1891, octavo, 576 pp.

This is printed as Part II of the twelfth annual report of the Director of the United States Geological Survey, 1890-91. It contains a report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson; hydrography of the arid regions, by F. H. Newell; irrigation in India, by Herbert M. Wilson. It is illustrated by 93 plates and 190 figures.

Dictionary of Altitudes in the United States, by Henry Gannett, 2d ed. Bulletin No. 76 of the United States Geological Survey, 1891, octavo, 393 pp.

This dictionary gives the altitudes at various points in the United States, including localities in the arid and semi-arid regions.

Bulletins of the Eleventh Census of the United States upon Irrigation, prepared by F. H. Newell. Quarto.

No. 35, Irrigation in Arizona, 8 pp.

"60, "New Mexico, 14 pp.
"85, "Utah, 23 pp.
"107, "Wyoming, 15 pp.
"153, "Montana, 32 pp.
"157, "Idaho, 26 pp.
"163, "Nevada, 24 pp.
"178, "Oregon, 26 pp.
"193, Artesian Wells for Irrigation, 27 pp.
"198, Irrigation in Washington, 17 pp.

Report on the Internal Commerce of the United States for the year 1890. Treasury Department 1891, octavo, 1174 pp.

This volume contains reports upon the condition of agriculture and of irrigation in Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington, in connection with statistics relating to the commercial interests of these States and Territories.

Canals and Irrigation in Foreign Countries. Reports from the Consuls of the United States in answer to circulars from the Department of State, 1891, octavo.

This report consists of descriptions of navigation and other canals in various foreign countries, and of irrigation on the continents of Africa, America, Asia, Europe, also in Australasia and the Hawalian Islands.

Irrigation and Water Storage in the Arid Regions. A report of the Chief Signal Officer of the Army in response to House resolution dated May 23, 1890, relating to irrigation and water storage in the arid regions, 1891, quarto, 356 pp. 37 maps. 51st Congress, 2d Session, House of Representatives Ex. Doc. No. 287.

This volume consists of a report on the climatology of the arld regions of the United States with reference to Irrigation by Gen. A. W. Greeley, and is accompanied by numerous diagrams and tables showing the monthly and annual precipitation at stations in Arizona, New Mexico, California, Nevada, Colorado and Utah. It is also accompanied by a report upon the climate of Arizona with particular reference to the rainfall and temperature and their influence upon the irrigation problems of the territory. Also a similar report upon the climate of New Mexico and California and Nevada.

1892

Report of the Secretary of Agriculture for 1891, octavo, 652 pp.

Contains, pp. 191-229, report of the division of Forestry

with remarks on water management; also, pp. 430-450, report of the artesian and underflow investigation and of the irrigation luquiry.

Irrigation of Western United States, by F. H. Newell, Extra Census Bulletin No. 23, September 9, 1862, quarto, 22 pp.

This report contains tabulations showing the total number, average size, etc. of irrigated holdings, the total area and average size of irrigated farms in the sub-humid regions, the percentage of number of farms irrigated, character of crops, value of irrigated lands, the average cost of irrigation, the investment and profits together with a resume of the water supply and a description of irrigation by artesian wells. It is illustrated by colored maps showing the location and relative extent of the irrigated areas.

The Climatic Conditions of Texas, especially with reference to temperature and rainfall, by Gen. A. W. Greeley, Chief Signal Officer, 1892, quarto, 120 pp. 52nd Congress,1st Session, Senate Ex. Doc. No. 5.

This report contains a description of the mean annual temperature and the variations therefrom, the cold waves, the precipitation in the form of rain and snow, its distribution throughout the year and its variability, also remarks upon droughts, evaporation, the amount of sunshine, wind movement and other meteorologic details. It is accompanied by tables showing the mean temperatures by months and years, and the monthly and annual precipitation at various localities. These facts are illustrated by numerous maps and diagrams.

1883

Report of the Secretary of Agriculture for 1892, octavo, 656 pp.

Contains, pp.293-358, report of the Division of Forestry.

1893

Certain Climatic Features of the Two Dakotas, illustrated with 163 different charts and diagrams, by Lieut. John P. Finley, 1893, quarto, 206 pp.

This report contains a description of the physical features of the two Dakotas, the meteorological records, the amount and distribution of ralufall, and its relation to irrigation, the droughts and temperature.

A report on irrigation and the cultivation of the soil thereby, with physical data and progress within the United States for 1891, accompanied by maps, illustrations and papers by Richard J. Hinton, 1893, octavo, four parts. 52nd Congress, 1st Session, Senate Ex. Doc. No. 41.

The first part consists of a general description of the growth of reclamation during 1891, the work on the great plains, and the results, the physical conditions in various States and Territories, and a number of papers by various authors upon different phases of irrigation. It contains 459 pp. with numerous illustrations. The second part consists of the final report of the Chief Engineer, Edwin S. Nettleton, with maps, profiles, diagrams and additional papers, the principal portion being a report by W. W. Follett, Assistant Engineer, upon a line of levels run in the vicinity of Cheyenne: Wyoming; Sterling, Nebraska, the Frenchman Iliver, Big Springs North Platte, Lexington, Loup River, and Grand Island Nebraska. Garden City, Dodge City, and Great Bend, Kansas. The third part consists of the final geological report of the artesian and underflow investigation between the ninety-seventh meridian of longitude and the foothills of the Rocky mountains, by Robert T. Hill upon the geology of Texas. The fourth part consists of the final report of the mid-plains division of the artesian and underflow investigation. This whole report consists of a revision of Senate Ex. Doc. No. 222, 51st Congress, 1st Session, noted above.

The Thirteenth Annual Report of the United States Geological Survey, 1891-92. Part III. Irrigation, 1893, octavo, 486 pp.

This report consists of three papers, the first upon

Water Supply for irrigation, by F. H. Newell; the second on American Engineering and upon Engineering Results of the Irrigation Survey, by Herbert M. Wilson; and the third upon the Construction of Topographic Maps and the Selection and Survey of Reservoir Sites, by A. H. Thompson. It is illustrated by seventy-seven plates and 119 figures.

A Geological Reconnoissance in Central Washington, by Israel Cook Russell, 1893, octavo, 108 pp. fifteen plates, Bulletin No. 108 of the United States Geological Survey, price fifteen cents.

Contains a description of the examination of the geologic structure in and adjacent to the drainage basis of Yakima River and the great plains of the Colorado to the east of this area, with especial reference to the occurrence of artesian waters.

1894

Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census, 1890, by F. H. Newell, 1894, quarto, 283 pp.

This report consists of a general description of the condition of irrigation in the United States, the area irrigated, cost of works, their value and profits. It also describes the water supply, the value of water, artesian wells, reservoirs and other details; it then takes up each State and Territory in order, giving a general description of the condition of agriculture by irrigation, and discusses the physical condition and local peculiarities in each country.

Fourteenth Annual Report of the United States Geological Survey, 1892 93, in two parts. Part II. Accompanying papers, 1894, octavo, 597 pp.

This report contains a paper upon Portable Waters of the Eastern United States, by W. J. McGee; Natural Mineral Waters of the United States, by A. C. Peale; Results of Stream Measurements, by F. H. Newell, illustrated by maps and diagrams.

A Geologic Reconnoissance of Northwest Washington, by George H. Eldridge, 1894,octavo, 72 pp. Bulletin No. 119 of the Geological Survey, price ten cents.

Contains description of the geologic structure of portions of the Big Horn Range and basin, especially with preference to the coal fields, and with remarks upon the water supply and agricultural possibilities.

1895

Year-book of the United States Department of Agriculture, for 1804, quarto, 608 pp.

Contains, pp. 155-176, Water as a factor in the growth of Plants, by B. T. Galloway and A. F. Woods; pp. 461-500, Forestry for Farmers, by B. E. Fernow.

Sixteenth Annual Report of the United States Geological Survey, 1894-95, Part II.

Contains a paper upon the Public Lands and their Water Supply, by F. H. Newell, illustrated by a large map showing the relative extent and location of the vacant public lands.

Annual Report of the Commissioners of Indian affairs, 1894, octavo, 1034 pp.

Contains description of irrigation ditches and works upon various Indian reservations.

Report of Progress of the Division of Hydrography for the calendar years 1893 and 1894, by F. H. Newell, 1894, octavo, 176 pp. Bulletin No. 131 of United States Geological Survey.

Contains results of stream measurements at various points mainly within the arld region and records of wells in a number of counties in Western Nebraska, western Kansas, and Eastern Colorado.

POINTS FOR EADA

R. T. J. Dodge, of Illinois, has a recipe for hog cholera which he says he has used for thirty-five years with great success. He says he has experimented by placing one well hog with a lot of sick ones, and keeping it well by the use of this remedy. The doctor says he regards it his duty to make the remedy known, and recently in an exchange he gave the prescription as follows:

Arsenic, ½ lb; cape aloes, ½ lb; blue vitriol, 4 lb; black antimony, one ounce. Grind and mix well the remedy before

The following are the directions for

using:

1. Sick hogs, in all cases, to be separated from the well ones, and placed in dry pens, with only 5 large hogs or 8 small ones in each pen.

2. Feed nothing but dry food, but no water, only the slop containing the rem-

edy, until cured.

- 3. When the hogs refuse to eat, turn them on their backs, and then, with a long-handled spoon put the dry medicine down their throats.
- 4. Dose for large hog: One teaspoonful three times a day for three days; then miss one day, and repeat amount until cured. Shoats and pigs, half the amount.
- 5. As a preventive, one teaspoonful once a week will keep your hogs in a healthy condition to take on fat.

Every Farmer is to a great extent a manufacturer and ought to keep a record of his operations. This is the key to success in any business. But the soil-tiller should attend to some other matters in connection with his accounts. A writer in an exchange suggests the map of the farm, with each field numbered, and its size, quality of soil, etc., specified, will be a great aid in keeping track of the year's transactions. How many farmers have such a guide and convenience? And how many kept such a memorandum the past year as will enable them to tell the expense of each crop grown? And

how about the domestic animals? If you keep cows, what have they paid you per head in the aggregate? And what of sheep, swine, and even chickens? How much did each contribute to your income, and which was the most profitable?

Timber Strips.—Many attempts at tree planting on the Western plains have met with poor success because they have been improperly conducted. The aridity of the climate requires that suitable varieties be selected and properly combined; that a sufficient mass of foliage be obtained to create favorable conditions of growth, and then that the trees should not be left to themselves, but should be as thoroughly cultivated as any crop of Sufficient experience has now been attained to demonstrate that when these conditions are observed timber strips can be successfully grown.

The New Celery Culture is the result of intensive gardening. It means larger and better yields from the same area. The new culture for celery consists of a system of close planting by which a part at least of the stalks can blanch in the shade of their own foliage. Rich soil, irrigation, and proper mechanical conditions of the surrounding earth are presupposed. Plants are set about five inches apart and the rows ten inches apart. Very rich soil is required and plenty of water for best results.

Preparing the Poultry.-Turkeys dry picked sell best and command better prices than scalded lots; the appearance is more attractive. Ducks and geese should be scalded in water as near the boiling point as possible, and it requires more time for the water to penetrate the feathers than those of other fowls. Leave the feathers on the head, and for two or three inches on the neck. Do not singe the bodies as the heat will give them an oily and unsightly appearance. After picking, hold in scalding water a few

seconds for the purpose of plumping, then rinse with cold water.

For Keeping Fruit.—The following rules for keeping fruit in winter are given in the Albany Cultivator: First, keep the temperature within a few degrees of the freezing point. Second, let it be as uniform as possible, as an occasional warm draught hastens decay. Third, exclude air currents not required to maintain ventilation and uniform cold. Fourth, keep all odors away from the fruit.

Try Sulphur.—No more effectual general agent for the destruction of disease germs has been discovered than sulphur. This fed to hogs does not always make them proof against the attacks of cholera, but its efficacy has proven so great in many cases that some of those who have used it consider it a sure preventive. The best form to administer is in the hard lumps, which hogs eat readily and without wasting it.

Feeding Turnips to milch cows is objected to by some on the grounds that the turnips taint the milk, contain too much water, and are not economical. Turnips have always been fed to cows in New England as well as the European countries and regarded as a good feed. The prejudice probably arises from not understanding that turnips should be fed after milking and not before.

Good Demand.—Two carloads of celery were recently shipped from Ogden, Utah, one to Kansas City, the other to Chicago. These are the first full car loads shipped out of Utah. Some Denver gardeners have shipped celery as far East as New York and Boston, but the lots were not large and were sent by express. One firm near Denver has a standing order from a large hotel in New York City for celery shipped daily by express.

Corn as a Pork-Maker.—It is generally believed that a bushel of corn will make ten pounds of pork. If this were true it would be much better for the farmers to feed their corn to hogs than sell it at present prices. Whether a bushel of corn is good for ten pounds of

pork or not depends largely on circumstances, and especially on the previous treatment of the animal itself.

OPENING OF THE CHICAGO MINING BOARD.

The Chicago Mineral and Mining Board will open for business on Monday, January 6, its location being on the banking floor of the great New York Life Building. At a meeting of members Monday, December 30, the following officers were elected: President, John Marder; first vice-president, Joseph Underwood; second vice-president, Charles E. Rollins; treasurer, John Hill, Jr.; secretary, Henry Burkholder;

attorney, John M. Palmer.

Standing committees were appointed as follows: Finance, H. W. Treat, J. B. Ream, J. Walter Proby, Morris H. Walker, Edward C. Billings; Arrangements, S. E. Magill, W. H. Underwood, Jr., Edward F. Bogart; Membership, Green B. Raum, C. S. Sawtelle, Robert Connelly, Horace F. Brown, A. H. Nelson, Timothy Cole, E. A. Webster; Arbitration, S. W. Fernald, George S. McKenzie, C. C. Chapin, Peter S. Daly, Peter Dudley; Listing, B. A. Seitz, M. A. Sheridan, R. H. Field, R. L. Martin, C. E. Gates; Statistics and Information, G. A. Downs, H. D. Griffin, Wilson I. Davenny, John Mayo Palmer, C. W. Pomeroy, Otto Gresham, L. A. Davis.

Chicago, New York, Denver, Helena, Salt Lake City, San Francisco, and other towns and cities in the Western mining fields are represented in the membership. Chicago banks have representatives, as also has the Chicago Board of Trade and the Stock Exchange. Total membership thus far, 250. An additional membership of 250 has been voted at \$250 each.

Every precaution is being taken to protect the public against fraud in dealing in mining properties and securities. The rules relating to the listing of mining securities are very rigorous. As is seen, the standing committees are composed of experienced mining men, and they have been given power to appoint auxiliary members who are resident locally in the mining districts of the West.

Besides the precious metals, the Board includes properties bearing iron, coal, lead zinc, tin, copper and all other minerals and metals.

THE EDITOR'S DRAWER

THE people of Illinois are proud of Dr. Clarke Gapen, the superintendent, and Messrs. Sill, Orr, Radeke and Granger, the Board of Trustees of the Illinois Eastern Asylum at Kankakee. In proving what irrigation will do for a farm in a State like Illinois those officials have benefited the agriculturists of the country generally.

The third annual convention of the Nebraska State Irrigation Association was held at Sidney. It was very largely attended and there was immense enthusiasm. The recent decision of the State Supreme Court gave every encouragement. Great progress will be made in irrigation projects during 1896. Speakers were present from all over the country and the benefits of general irrigation were clearly shown.

PLATFORM for 1896: 1—Federation of all agricultural organizations. 2—Smaller farms. 3—Irrigation. 4—Diversified crops. 5—Improved public highways. 6—Uniform, cheap railroad rates. 7—Free rural mail delivery. 8—Let your legislators and Congressmen know what you want.

Free Silver was declared for by the Trans-Mississippi Commercial Congress. A great exposition of the products of States west of the Mississippi river was advocated, and resolutions adopted asking the National Congress to make an appropriation in aid of it.

Conference of the Bi-Metallic Leagues of Great Britain, France and Germany, now going on in Paris, has for its object the drafting of an agreement regarding bi-metallism which will be submitted to the parliaments of the three countries.

In the National Grange the resolution was stripped of the export bounty clause, and, as adopted, favors protection to farming, and requests Congress to investigate the merits of Lubin's plan.

WITH her mineral and Mining Board, and also a Mining Exchange, Chicago will

be the central point for investors. New York also has a mining exchange.

THE Wisconsin State Grange adopted a series of resolutions urging that "the government should monopolize the issuing of money, and make the volume of legal-tender large enough to supply the wants of the people."

Senator Chandler's Bill for the unlimited coinage of gold and silver provides that the law shall take effect when similar laws have been adopted by England, France and Germany. A majority of the Senate favor free silver.

A DECISION as to the constitutionality of the Wright law in California is about due from the United States Supreme Court. This decision will have a direct bearing on the irrigation laws in all the Western States.

In order to prevent the necessity of further bond issues, revenue for government expenses must be raised by restoring the duties on some commodities, and two of these are wool and woolen goods.

RAILROADS are the great developers, and a big boom in railroad building—actual building—is announced from all the far Western States and Territories.

If there should be war, wouldn't prices of breadstuffs, meats and horses go booming! A great many people are afraid Great Britain may back out.

ILLINOIS, Wisconsin, Minnesota, Indiana and Ohio have members of the National Irrigation Congress. At the next session every State in the Union will send delegates.

THE Harvey county (Kansas) colony who went to Louisiana three years ago have just arrived back—on foot.

THE American Bi-Metallic League will attend the silver conference at Washington, D. C., the 22d of this month.

What about our own boundary line dispute with Great Britain—that Alaska line?

TOPICS OF THE TIME

The arid regions will have Spread of to look to their laurels for Irrigation. irrigation is becoming general and no mistake. It was the general drought throughout the country the past season that has awakened the agriculturists of the rain belt. Illinois already has one wonderful irrigated farm and the coming season farmers in various sections of the State will adopt the safe plan for crops. Wisconsin, Iowa and Minnesota will also have irrigated farms, and similar announcements come from Indiana, Ohio, Pennsylvania and other States, while the irrigation operations in the South will be largely increased. It has come to be generally appreciated, that irrigation, with diversification of the crops, is the sure road to prosperity.

Tiding A big trust company has just Them been organized in Chicago, the Over. business of which will be to loan money to cattle ranchers and farmers who are not ready to market their herds or crops. By the aid of this company it is urged that cattle, corn, etc., need not be sacrificed when prices are as at present. Of course the company will make money but its operations will prove most beneficial to people who need to be tided over. Among those at the head of the organization are P. D. Armour, E. A. Cudahy, Herman Kountze, John A. Creighton, J. M. Woolworth, Fred Davis, John A. Mc-Shane, W. A. Paxton and several Boston and New York capitalists. The capital is \$1,000,000. Offices of the company will be located at Omaha and Kansas City.

Armies With the new flood of of gold, or the prospect of a Immigrants. new flood of gold, armies of immigrants will take their way to the Western States and Territories in the Spring. From every section of the country co-operative parties and individuals will be leaving. It is likely, too, that inasmuch as the present boom has reached every part of Europe, immigrants to this

country from the Old World will, more generally than usual, be ticketed through to the Western States and Territories. All this being true, Western America might as well prepare to provide for them. If there is not employment in the mines for all of these people, there are irrigation farmsacres sufficient for all. The mining boom has attracted the people generally, as well as the capitalists and investors of this country, but if hosts of poor men, expecting work, reach Colorado and other States and Territories in the winter season and find nothing to do, their plight will be a sad And this is just the prospect at Poor men from every point are present. working their way West. It would be a humane act for the State officers of Colorado to publicly notify the working people of the country of the present situation and the chances of employment. Men with a little means can go out West at any season and get along, but it is no poor man's country in the winter time.

West All the efforts of the merchants and of Chicago and the West to open South. up trade with the Southern States having failed, that rich field has for years been almost abandoned, and New York and the East have been the gainers. Spasmodic attempts have been made to solve the mystery as to why the South preferred to trade with New York when it could do better with Chicago, but nothing satisfactory could be ascertained. When the railroad magnates were inquired of, the answer invariably was, "Oh, the Southern States have their trade relations with New Yorkestablished for years and they will not make any change." But with the Atlanta Exposition, and the mingling of Western farmers, merchants and manufacturers with those of the South, the whole matter is cleared up, and the prospect is that hereafter shipments from the West to the South and vice versa will prove a big factor in the commerce of the country. It is conclusively proven that for years past the railroads, at the instigation of New York and

the East, have been discriminating against the West. A strong alliance is being formed between the West and South for the building up of cotton manufactures in the South in competition with New England, and Chicago is to hold a great exposition of cotton and Southern cotton manufactures. It is not impossible that the West and South may act together on various questions, one of these being silver.

Western The announcement from Farming Springfield, the State capital, says of the incorporation: Lands. "The Chicago Mineral and Mining Board, at Chicago; without capital stock; to provide facilities for dealing in ores and securities of corporations engaged in developing mineral deposits; incorporators, Green B. Raum, Joseph Underwood and John Mayo Palmer." Three better known men do not exist in Chicago or in Illinois. Ex-Governor Palmer has a national reputation. This enterprise is a board where parties and companies having mining claims or properties can meet capitalists, and part of the project is the rigid investigation of all properties attempted to be floated. cago will also have a Mining Exchange, but this board must not be confounded Western America may well be with it. congratulated that Chicago has taken hold and will aid in the development of the mineral resources, and also the agricultural resources, for Western agricultural lands will be operated in on the Mineral and Mining Board. Now is the time for the Western States and Territories to push their lands into the market. Careful, conservative investors take more readily to agricultural lands than to mining shares, and of the armies of men who go West in the spring to dig gold many must remain to irrigate. It must be remembered, too, that the big new population in the mining camps must be fed and that grain, vegetables and fruit and cattle and hogs and mutton are necessary to feed them with. That 1896 will witness great strides in the development of the West is a foregone conclusion.

Wool The rank injustice of taking and the duties off wool and lumber Lumber. is now generally realized and condemned, and Democrats in the wool and lumber States are loudest in their complaints. A gallant fight has been made to

have duties restored, and if this fight is kept up, it can not fail of success in the present Congress. Revenue must be raised, and the articles that should be taxed are those mentioned. It will be "tariff for revenue only."

In the present age every class For Success, of business—every profession Organize. even—is organized. trades are organized, and even unskilled labor is more or less organized. Business, banking, and railroad and water transportation are organized into immense trusts or pools. Now, in order to obtain their rights, hold their own and advance to prosperity, farmers and stock raisers must more closely organize. This closer organization was advocated at the meeting of the National Grange and it was also advocated at the subsequent meetings of the State Granges of Illinois, Indiana, Michigan, Kansas, Missouri, Nebraska, etc. Every man engaged in farming and stockraising must be gathered into the fold. With this thorough organization, every question affecting agricultural interests can be regulated; all needed legislation can be secured. At the recent meeting of the Illinois Grange, Mortimer Whitehead. formerly one of "Uncle" Jeremiah Rusk's right hand men, made a ringing address in which he scored the politicans and their methods and urged co-operation among the agriculturists in everything. Governor Altgeld spoke at some length and advised the farmers to organize and look out for their own interests, intimating that if they did not do so they could not expect others to do it for them.

There Will the great output of gold Is No bring the ratio of gold and silver Ratio. together ?" ask the great leading editorials in the dailies. ever may be said for or against the free coinage of silver, it is a fact that a great deal of the hostility to it comes from the common notion that as things are now there can be any ratio between gold and silver. At present, silver is simply a commodity, the same as copper. Copper is not spoken of as having any ratio to gold simply because a quantity of copper has been taken to make pennies out of, and why should silver be spoken of as having a ratio to gold simply because a quantity of silver has been used to make dollars

out of? How can silver bullion have any relation to gold when silver was demonetized or destroyed as final redemption money? No kind of metal can have any ratio to gold unless it is used as primary money, and then the ratio will be exactly There can be but what the law wishes it. one legal ratio between metals; that one is made by law, and the law of supply and demand will always compel the commercial ratio to be very close to the legal ratio. But now there is no ratio at all in the United States between any kind of metals because there is only one metal made into primary money. Hence, there is unnecessary fear that the commercial ratio between gold and silver, in case of free coinage of silver, would ever vary very much from the legal ratio.

Down With the new ruling against the Beef bogus butter and the seizure Combine! of unbranded eleomargarine at several points, comes more trouble for the Chicago packers. It is understood that the new Grand Jury ordered for the United States District Court in Chicago will bring in indictments against the beef combine. It is known that the information gathered by the special agents of the Department of Justice and the Agricultural Department will be presented to the jury.

Confidence Those bright Northern Again lights are indications of Returning. returning confidence, and sure signs of a new era of prosperity. The lights are from the great blast furnaces of Northern Wisconsin and Michigan. The friends of protection to home industry are again in power at Washington and all the great iron and steel mills will soon be going again under full headway.

Robbing The Chicago Board of Trade is Grain expelling members and doing Growers. all it can to reform itself. The board is unable, however, to get from under the control of the elevator ring, which has absolute sway in the handling and shipping of grain. This ring is an absolute detriment to Chicago and is a bloodsucker to every grain grower in the West. The State legislature should investigate and break up this nefarious combination, but it is afraid. It would be a blessing to the agriculturists of all Western America if the

farmers of Illinois would make a political issue of the elevator abuses in Chicago and elect a legislature pledged to break them up. A majority of the members of the Board of Trade would gladly render their assistance. The Illinois State Grange, which has been such a great sufferer, has opened the ball against Chicago methods. At its recent meeting a special committee was authorized to draft a memorial to Congress requesting that stringent legislation be enacted against option dealing—gambling—in grain, and the use of the telephones and telegraphs for that purpose.

THE National Grange and various State Granges demand that Secretary Morton be retired and that "a man be chosen from the ranks of the farmers, with a knowledge of agriculture." Farmers strongly approve the rebuke given to Mr. Bayard, the Minister to England.

COMMISSIONER LAMOREUX urges the necessity of a national commission to regulate the distribution of irrigation waters in the West.

That fraud, oleomargarine, can not masquerade any longer as butter under the name "butterine." It must be stamped "Oleomargarine."

THE Illinois and Michigan State Granges declared for the remonetization of silver, and against the retirement of the greenbacks.

No way of successfully fighting the sugar and oil trusts, and the beef combine has yet been discovered or invented.

A GOOD ROAD is being built from Chicago along the lake shore through Kenosha and Racine to Milwaukee.

THE Western States are to have possession of their grants of arid lands before the lands are irrigated.

An irrigation plant and a mortgage never remain long together on the same farm.

CHICAGO permits the sale of horse meat for food.

THE Chicago Metal Reduction Company has increased its capital stock.

THE sugar bounties are to be paid.

THE SILVER ELEMENT SHOWS ITS TEETH.

The revenue bill passed the House by 205 to 81, some Democrats voting with the Republicans in favor of the measure. As passed, the bill repeals the present tariff law until August 1, 1898. It restores 60 per cent of the McKinley rates . on wool and woolens, lumber and carpets, and makes a horizontal increase of the present rates in all other schedules, except sugar, of 15 per cent. The House passed the Republican (gold) bond bill by 169 to 136. It was on this bill that the silver element showed its strength and its Democrats and Populists disposition. voted solidly against the measure, and were aided by forty-seven Republicans, several of them from the South and all the others from the West and Northwest. The President and Secretary Carlisle of course fight both these bills. Silver rules the Senate and the bond bill stands little chance there, but men like Senator Thurston of Nebraska are of the opinion that, after lengthy debate, the revenue bill will pass. If it does, the President may allow it to become a law without his signature.

In advance of anything Congress may attempt in regard to the gold bond bill, the President has decided to issue \$100-000,000 more 4 per cent thirty-year bonds.

ANOTHER CHICAGO REDUCTION COMPANY.

Certificates of organization has just been issued to the American Reduction Company, at Chicago; capital stock, \$150,000; to mine, smelt and reduce ores. The incorporators are Walter J. Doere, J. A. Pollock and S. S. Willard.

A CRISIS IN THE INTERSTATE COMMERCE LAW.

The Interstate Commerce law is approaching a crisis. The case filed in New York against the Joint Traffic Association will make it or break it. The Government will do its utmost to sustain the law. Thirty railway companies owning and operating nearly 31,000 miles of road and capitalized at \$1,000,000,000, are combined against it, The Government is by no means certain of success. Much depends upon a decision in what is called the Brown case, to be made early this month in the United States Supreme

Court. This decision will determine for good the right of the Commission to compel railway men and shippers to testify. If the Brown case is lost the Interstate Commerce act is lost and the Commission is lost with it.

AFTER THE BEEF COMBINE.

Kenesaw M. Landis, formerly private secretary to Secretary Gresham, has been appointed a special assistant United States attorney for the Northern District of Illinois to appear in behalf of the Government in the prosecution of the beef combine among Chicago packers. His duty will be to direct the investigation now in When Secretary Morton was progress. in Chicago some time ago he expressed a desire to proceed with more rapidity in the investigation. He had several conferences with the men employed to secure evidence. Col. L. Monroe Haskell, of the Department of Justice, and Edward Sheldon, of the Agricultural Department, have been in Chicago for a long time looking into the charges against the combine, and have made frequent trips out of the city. Mr. Landis will, as Gen. Black's assistant, look after the legal end of the work. A great mass of convincing evidence will be presented to the Grand Jury which has been called for January 14. A large number of cattle men from all over the West will be present and testify before the Grand Jury. The packers have retained able counsel and will make a hot contest.

GETTING THEIR LANDS BACK.

Judge Randolph, in the District Court at Emporia, Kan., has decided that a deed cannot be given after foreclosure and sale by the sheriff, and instead ordered a simple certificate of purchase. The plaintiff will take the case to the Supreme Court. This decision will save to the citizens of Lyons, Chase and Coffey counties alone over half a million dollars, as it means that in a majority of the cases which have been foreclosed and embraced under this act the debtor may pay into court the price at which the land was bid in, together with the interest, cost and taxes, and get the land clear.

MACHINERY AND APPLIANCES

IRRIGATION is no longer confined to the arid regions. Farmers generally in Illinois and throughout the Central States, and in the East and South are going into irrigation. With this change comes a great demand for irrigating machinery and devices, but improvements are demanded and inventors who can produce the necessary machinery at cheaper prices than rule at present have a great field before them. Whether wind, steam or electricity, or all of them, are used, the great necessity is less expense. Past experience, very recent and very bitter, has demonstrated that the age of prayer for rain must be relegated to the rear. Farmers with fine holdings in the most fertile States of the Union, with great water courses near them, are tired of getting only part of one crop a season after a hard season's work and anxiety, when during the same season, under the same and much worse conditions, the farmers on arid lands and much smaller holdings, turn out several bountiful crops. They, too, will irrigate, for, with what has been considered plenty of rain, an irrigated farm in Illinois, or any other State, will bear four-fold greater than a farm that is not irrigated. Irrigation is found to be superior to the natural rainfall!

The drift of the times is toward general improvement in farming, and irrigation and diversification of the land crops are at hand. In the future, too, the farms will be smaller, every inch will worked, and nothing neglected. Methods will be changed, implements improved, and skill employed in packing and distribution. Farming has not kept pace with any other industry that can be mentioned. The thorough organization among the agricultural classes will aid them to advance—is already aiding them. A former well-to-do farmer residing near Springfield voiced a general sentiment at a meeting recently when he said: "I was actually thinking, after all these years, of leaving dear old Illinois for the But no. I will remain here and employ advanced methods. Irrigation is a success on arid lands. They resort to it, indeed, in the South. Now I am going to irrigate right here. If improved and cheaper pumping plants are offered, well and good, but I won't wait for them. In farming, I am going to keep abreast the times hereafter, just as other industries do."

As to the means to be employed for irrigation in Illinois and other Central States, they will be various. Lands near streams will of course obtain their water by pipe lines, while in other sections there will be wells and reservoirs, and various modes of power will be employed, the cheapest and best of course becoming the most popular. There will be gas engines and oil engines, and the wind-mill, too. It is promised, indeed, that some electrical surprises will be sprung at an

early day.

There are suggestions for new beginners in the reports from Kansas, where the people are enthusiastic for the safe plan of farming. The number of farmers irrigating in Kansas for the first time in 1888 was 26; first time in '89, 13; first time in '90, 28; first time in '91, 18; first time in '92, 33; first time in '93, 55; first time in '94, 224; first time in '95. 1,241. The total number of irrigators in 1895 was 1,638. It is seen that the growth of the industry was most rapid. And Kansas is the State that Governor Morrill and Mr. Burton boast of now as "the garden spot of the West." The depth of their wells varies all the way from 10 feet to 240 feet, the average money cost of windmill plants, not including any labor by proprietor, \$118; of steam plants, \$293; of gasoline plants, \$486; of horse power, \$73. These figures are given by the Kansas State Board of Irrigation. Number of answers to the question "Is irrigation by pumping a success?"affirmatives, 338; negatives, 6. In their neighborhood, the waters of the streams are of course utilized.

Inventors and manufacturers will find it a paying investment to devote some thought to the question of cheaper pumping plants for irrigation purposes.

Electricity is making its way to the farm work at last. In the line of harnessing it for work, a Danish farmer has made a successful experiment of its use for threshing. It is not, however, as a motive power alone that electricity promises to assist the agriculturist. French scientists have been at work experimenting with it as to its influence on growing crops. They have succeeded in hastening the germination of peas, beans and corn by the use of the electric current. nouncing batteries and powerful engines, which are too expensive and intricate for farmers to use, they have used a new invention called the geomagnetifere, which consists of an ordinary pole forty to fifty feet high, on top of which is insulated a row of copper spikes to collect electricity from the atmosphere. An insulated wire transmits the fluid to a network of galvanized iron wires buried four to six feet under the crops to be experimented on. The electricity seems to act as a powerful fertilizer.

C. M. Palmer, of Fond du Lac, Wis., has received a patent on an improved clipping machine for shearing sheep. The machine is operated by a small electric motor and is said to have increased the capacity.

He's a fine old Irish gentleman,
But he's angry when he's vexed.
He'll buy you drinks one minute,
An' break your face the next.
He's a fine old Irish gentleman—
He's a pal as you can trust:
He's all right when you knows him,
But you's got to know him fust.
—Minneapolis Journal.

A MODEL GASOLINE ENGINE.

In Texas a very large number of Weber gasoline engines are in use on ranches and in towns. They operate feed mills and newspaper presses and corn shellers and grinders on feeding ranches as well as having a multiplicity of uses in the towns. In California and Arizona they are used in irrigation plants and to operate hydraulic and other mining machinery. On Kansas farms they shell and grind corn, run threshers and pump water from murky creeks into irrigation ditches. A vast number of them are in use in Louisiana, where they are used on rice plantations and as general farm engines.

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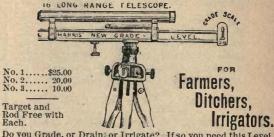




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THE IRRIGATION AGE.

VOL. IX.

CHICAGO, FEBRUARY, 1896.

No. 2.

THE BROADER SIDE OF THE IRRIGATION MOVEMENT.

BY THOMAS KNIGHT.

WHETHER it be or be not possible to reclaim by irrigation some certain portion of the arid and semi-arid regions of this country is undoubtedly a question of importance per se; regarded simply as a local issue there has as yet been no adequate comprehension of the problem by those whose very existence would appear to depend upon its satisfactory solution.

This being the case, it is not surprising that attention to detail and consequent narrowness of the field of observation have, to a great extent, prevented any general recognition of the great principles which, underlying the Irrigation Movement, have given to it most of its influence and all of its vitality. And since the irrigationist insists that not only are these principles true, but will in their application be found to present a means for meeting at least some of the social difficulties of the hour, it is at least reasonable that examination be made of them and the correctness of such a position be discussed.

There are in the world two great economic forces, Labor and Capital. Together they form a prime mover; separately they are impotent. Labor, however, has one advantage in that it is the capital of every man who is able to work, and should at all times be readily convertible into the necessaries of life for its pos-

sessor.

But it is a lamentable fact that in all civilized nations there is at the present time an inability on the part of labor to effect this conversion, and the tendency

is undoubtedly towards a still greater stringency in the condition. It is manifestly impossible to compel capital to employ labor where the natural demand for such labor is non-existent; what then can be done to enable the laborer to exist, supposing him willing to dispose of his labor but unable to find a purchaser? The irrigationist contends that the necessities of the laborer do in themselves constitute a natural demand which will tax all of his energies to meet, and proposes that he be given the opportunity to satisfy this demand directly, without the competition attendant upon a congested labor market or the evils arising from the fluctuation in values induced by empirical and unstable national legislation.

But labor to be thus utilized must certainly have within its reach such raw material as will absorb it profitably. And it is clear that the ultimate worth of such lies in its capacity to increase in value according to the amount of labor employed upon it. If, in addition, such raw material is capable of not only a cumulative but a recurrent increment, its ultimate worth is incalculable, inasmuch as such cumulative and recurrent properties are

practically infinite.

It is in this light that the irrigationist regards the land. As raw material he maintains that, under irrigation, it is capable of making a remunerative return in direct proportion to the amount of labor bestowed upon it. For since the extent of any man's actual necessities depends

not in the least upon the cost of satisfying them, any return which is sufficient to provide these is remunerative, and unless a rise or fall in prices could govern the amount produced from a given area of land by a given amount of labor (which proposition is absurd), it is clear that this return will be both stable and reliable, and thus exactly meet the demand which it is required to satisfy.

That such a result is possible is demonstrated by the facts. The product from an acre of irrigated land under any crop has not yet been even approximately determined, nor does it appear capable of such determination. It is, therefore, a legitimate assumption that while the irrigationist is perfectly safe in his estimate as to the population which may derive support from a given area under conditions favorable to intensive cultivation, it is altogether out of the question for objectors to urge either that the limit of production will soon be reached, or that the available land will be exhausted.

But supposing any such objection were well founded, which it evidently is not, it simply amounts to the proposition that unless our unoccupied lands will absorb the whole of our unemployed labor it is useless to utilize them in the absorption of any part thereof; a position so nearly approaching the ridiculous as to demand no consideration.

Presuming, however, it be conceded possible to fix on the one hand the limit of production, or on the other the extent of cultivable land, it will be at once seen that even this by no means determines the amount of labor provided with employ-The development of the mining districts of the West depends almost entirely upon the ease with which sustenance may be obtained for the labor employed therein. If 100 acres of irrigated land in the neighborhood of such of a district will produce a surplus equal to the support of five men, those five will assuredly set to work upon unoccupied land (other than agricultural) which can now afford no return whatever. And so widespread are these effects that wherever such surplus can be transported at any reasonable cost they are found to operate; without the irrigated fields of Colorado one half at least of her mines would be idle, and all her dependent industries suffer in proportion.

The State of Wyoming today, with her river sands full of gold, her hills rich with mineral, her subterranean shales saturated with oil, waits for what? The intensive cultivation of those fertile acres which will afford not only support to those who till them, but from their surplus maintain the army of workers who shall render these treasures available to the uses of mankind.

Hence it follows that while intensive cultivation means enormously increased returns from the land (and the aim of the irrigation movement is to secure not only larger yields per acre but also extended area under crop), it is by no means a consequence that such a result implies over-production or even any increased competition in the markets; for the bulk of the labor which would derive its direct sustenance from the soil is just that which now is unable to enter the market as a purchaser, while the surplus, as we have seen, would go to supply the demand created for it by the opening of fields for industry which are now non-existent.

If it be true that the real advances in civilization have always been made through its industries, it would therefore appear that the irrigationist will be largely concerned in the transformation which our social life is now undergoing. possibilities of production from a very small area of land surely point to the massing of population, not in overgrown cities, but in colonies of small holdings, in which all the advantages of urban life may be enjoyed, and many of its evils eliminat-Unless there be any disadvantage to mankind in the exercise of the traits common to humanity which call for social intercourse and intellectual advancement, this tendency cannot be deprecated; the irrigation movement is the outcome of an irresistible demand for the means to meet higher ideas, and its success will be in proportion to its capacity for their satisfaction.

If it be borne in mind that legislation under a popular form of government can never be in advance of social requirements, but must depend upon them for its inception, the necessity for a just comprehension of the broader side of the irrigation movement will be readily conceded. That much of our existing legislation is entirely inadequate to our present social needs admits of no doubt, and it is here that the

irrigationist unflinchingly joins issue with the opponents of the movement. If, as they urge, it is impossible to meet his reasonable demands because existing legislation is adverse, or insufficient, his position is that such legislation must be amended, and by no means that social progression be for a moment retarded thereby.

In order to render such a position tenable, it is undoubtedly necessary for the irrigationist to urge far more than a purely local or transitory issue. This he squarely claims to be doing, and he estimates his labors solely according to their beneficial results upon the whole commonwealth.

It is from a study of the broader side of the irrigation movement that any just appreciation can be placed upon these; it is from an unprejudiced consideration of its aims by the public, and their unfaltering prosecution by its friends, that success may be expected in their attainment.

WATER SUPPLIES FOR IRRIGATION.*

II. ORIGINAL RESEARCH—RAINFALL AND STREAM DISCHARGE.

By F. C. FINKLE, C. E.

No irrigation engineer can afford to give a project his unqualified endorsement by basing his examinations and opinions wholly on the data derived from reports made by others, no matter how complete and full such reports may appear.

The most perfect human minds have their failings and are liable to mistakes, and reports, especially those prepared under government supervision, often contain serious errors, inaccuracies and omissions caused by carelessness or a lack of proper interest in the work. The importance of verifying data obtained from other sources than from personal investigation and research is therefore apparent.

It is often the case that no reports, governmental or otherwise, are obtainable, from which any information about the particular locality in question can be drawn. This may be due to one of several causes. The country may be new and unexplored or only partially explored; the data known may be too limited or conflicting to be considered reliable; the region may heretofore have been considered of too little importance to merit investigation at the public expense, or some other cause, known or unknown, may be responsible for the existence of no reports in relation thereto.

In cases of this kind original researches have to be commenced *de novo* and completed before any conclusion can be reached.

We will now endeavor to discuss the methods to be employed and the manner in which the work should be done in order that a perfectly fair, reliable and conservative conclusion may be arrived at.

One of the principal things, and one which requires the most careful and long continued observation to determine, is the rainfall on the watershed tributary to a stream. For the determination of this a pluviometer should be employed on as many different stations on the watershed as possible.

A pluviometer is an instrument for ascertaining the amount of rain which falls from the clouds. It is usually made of brass or some other metal not easily corroded and consists of a cylindrical dish with open top and a long tube connected to its bottom, which is otherwise closed, the tube being of such diameter as to give a sectional area equal to one-tenth of the top area of the dish itself. The edge at the top should be very thin and the measuring rod, for which allowance in proportion to its thickness must be made in proportioning the sectional areas of the dish and tube, should be graduated in inches and tenths of inches. This instrument, when in use, should be set in level, open ground with its top just above the top of the grass and apart from buildings and other obstructions, and the weeds and grass should be kept trimmed below its When these conditions are observed

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the depths shown on the measuring rod on the tube will be ten times the rainfall in inches.

In places where snow falls, a round dish of equal diameter at top and bottom and of sufficient depth to receive all the snow which may fall in any one storm is used. This dish should be securely set in an open, level place so as to receive all the falling snow due to its area and so as not to allow any snow to drift into it. After each storm the snow should be melted and the obtained depth of water measured, which together with the depth of the snow before melting should be carefully record-For accurate gauging the practice of placing the instrument on the roofs of buildings or on other objects elevated above the surface of the ground is to be condemned, as, at any considerable elevation above the ground, the drops of rain in their downward course are deflected in their vertical descent by the force of the wind and less water will enter the raingauge than the proportion due to its sectional area. Fomulæ which have been suggested for making corrections for different elevations are practically valueless, as so much depends on the relative force of the rain and wind, factors which it is impossible to determine accurately.

In making observations of the rainfall on a watershed, rain-gauges should be placed so as to cover all points where a material difference in the precipitation is likely to occur. The location of the gauges should be correctly determined, so that, when the watershed has been surveyed, the exact points of all observations can be noted on the plat as stations and numbered. A record of each station should be kept showing the date and

amount of rainfall each day.

The character of the gathering ground upon which the rain falls has considerable to do with flood discharges from a watershed. The maximum may in some cases reach two thirds of the amount which actually falls; but this is only to be depended upon when the watershed is small and the surface impervious and barren, and the ground frozen and free from snow. It is impossible to give the maximum discharge with any claim of reliability in the case of large watersheds with loose soil, except where data have been collected in regard to that particular

watershed by actual gauging of the rainfall and measurement of the discharge. Some cases are of record, where the discharge from a large basin with loose ground and slight descent has been so insignificant as to amount to practically nothing.

With zero as a minimum and two-thirds of the total rainfall as the maximum, results vary so much that no ratio can be confidently named even with a good map and description of the watershed at hand. Absolute safety in making estimates of the ratio of discharge for a given rainfall lies in having made a sufficient number of measurements of the flow in the outlet channel to establish a rule applicable to the watershed in question.

In calculating the volume of flood water falling on a given watershed there are three factors to be taken into consideration, i. e. (1) Area of watershed. Depth of rainfall and (3) duration of precipitation. By means of these factors we can find the number of cubic feet which have actually fallen from the sky during a But in hydraulics the time as well as quantity are considered so that water is always measured and estimated by the rate of flow in a given space of time, and the units adopted are the cubic foot of water and the second of time, so that the rate of flow is expressed in cubic feet per second.

We now have everything necessary for establishing a formula by which can be determined the rates of a volume of water falling on a known area exposed to an observed precipitation for a given length of time in cubic feet per second.

This formula is expressed as follows:

$$Q = \frac{A \times D}{S}$$
, in which

Q = Flow in cubic feet per second resulting if all the water falling were discharged uniformly in the same length of time which it has taken to fall.

A = Area of watershed or basin exposed

to the rainfall in square feet.

D = Observed depth of rainfall by the pluviometer or rain-guage in feet.

S = Time in seconds during which the observed depth has fallen.

The following table may be of use in making approximate estimates without employing the formula:

TABLE No. 1.

Volume of precipitation per second of time for a given depth in feet, per twenty-four hours.

Rainfall in 24 hrs.	Vol. of rainfall per second on 1 sq. mi.	
FEET.	CUBIC FEET.	
0.25	80.6683	
0.50	161.3312	
0.75	242.1635	
1.00	322.8264	

From the above table the volume of rainfall can be found for any of the given depths, observed in twenty-four hours, by multiplying the figures in the second column by the area of the watershed in square miles. For depths of rainfall other than those given, the cubic feet per second for one square mile can be found by simple proportion, and then for the whole watershed by multiplication, as before.

Recorded measurements show that the flood volume of streams varies inversely as the area of the tributary watershed or basin. Usually the larger the basin the less in proportion to its area of watershed will be the rate of flow of flood water at its outlet. This is due to the fact that the proportion of pervious soils, open and porous ledges, intercepting stratified formations, easy slopes and still water basins is so much greater in large drainage basins than in smaller ones, that a much larger proportion of the water falling reaches underground courses and receptacles. small tributary basins the opportunity for loss is much less and the rate of flow consequently greater.

The time when the flood flow takes place at the outlet of a basin, like the rate of flood flow, varies inversely as the area of the basin. In small watersheds and the basins of tributary streams the period of maximum flow follows immediately after the maximum rainfall, while in the main outlet channel of a large basin the flow may not begin for from one to four days, and sometimes even more.

The length of time which the flood discharge from a stream lasts usually corresponds very closely to the length of the storm, although in the case of large basins the discharge sometimes begins after the storm is entirely over, this time being consumed for the first water to reach the outlet.

In the case of elevated watersheds, where

the larger portion of the precipitation comes in the form of snow, the discharge of the flood water coming from the subsequent melting of the snow may continue for a long time, and the effect of a storm may continue for weeks or even months.

DETERMINATION OF FLOOD VOLUMES.

A large number of different formulæ have been invented in different countries for calculating the flood discharges from river watersheds. Most of the experiments made for the purpose of devising satisfactory formulæ have been by Indian engineers. Mr. Dredge proposes the following, which has hitherto been very popular among hydraulic engineers:

$$Q = 1300 \, (\frac{M}{L^{\frac{3}{3}}})$$
, in which

Q = Volume of discharge in cubic feet per second.

M = Area of watershed in square miles.
 L = Length of watershed in miles.

The record of maximum flood discharges of American streams are few in number, and for this reason it has been impossible to construct a formula epecially for this country which would give as close results as might be desirable. In addition to the difficulty due to the insufficiency of recorded observations, another serious difficulty in the way of constructing a general formula for the whole of the United States arises from the fact that there is quite a considerable difference, meteorologically, between extremes of the country. In the New England and Middle States, and most of the United States lying east of the Mississippi river and north of the Mason and Dixon line, hydraulic engineers use the following formula, which has been obtained by comparing the data furnished from measurements taken in that region:

$$Q = 200 \, (M^{\frac{5}{8}})$$
, in which

Q = Volume of discharge from the whole area measured in cubic feet per second.

M = Area of watershed in square miles. To find the discharge per square mile, the formula may be expressed as follows:

$$Q = \frac{200 \text{ (M}^{\$})}{\text{M}}$$
, in which the

letters have the same value as given above.
In the southern and western portions of
the United States the measurements made

and recorded are even more meager than in the portions already referred to, and as a consequence the formulæ in use for determining the maximum flood discharges of streams are even less accurate.

In the Southern States the best results have been obtained by the use of the formula already given, but in the following form:

 $Q = 250 \, (M^{\S}),$

and in the portion of the United States lying west of the Mississippi River, with the exception of a few localities, the following form of the formula has met the greatest approval:

 $Q = 150 \, (M^{\,8}),$

in both of which the values of the letters

are the same as already given.

Results obtained by the use of any of the formulæ given above are not claimed to be exact, and can only serve to give some idea of the rates of flow which may be expected from maximum floods in the different localities. In making rough preliminary estimates these formulæ are useful for determining the maximum flood discharges of rivers as well as the approxi-

mately safe proportions of structures intended to span the streams, to divert water from them or to provide spillways for dams. But before any final plans and estimates are made or contracts entered into. the nature and history of the particular locality should be carefully ascertained and studied, and such measurements and observations made as time and opportunity will allow, in order that the formula may be modified to suit the particular locality and conditions involved. For making exact and reliable determinations of the maximum flood discharges from any watershed, topographical, geological and meteorological characteristics must be known and used to modify an existing formula or to construct a new one for use in making the necessary calculations.

The general formulæ already given, when used intelligently, can easily be modified so as to take into consideration the extreme precipitousness or flatness, perviousness or imperviousness of the surface, and the particular degree of precipitation which characterizes the particular basin in

question.

(To be continued.)

THE ART OF IRRIGATION.*

CHAPTER IX. IRRIGATING WITH FURROWS.

BY T. S. VAN DYKE.

SSUMING that the ground is fine enough to hold up the small streams of water mentioned in Chapter VII without letting them drop through too quickly, you will generally find it best for all orchard and garden work to irrigate with furrows instead of flooding. You will find this true whether working the ground for pleasure or profit and whether on a large or small scale. Furrows do better and cleaner work and when everything is arranged as it should be the labor is generally reduced to a minimum. results are those of a long, slow, soaking rain, whereas flooding at the very best has too much of the effect of a short and pouring shower. As flooding is sometimes the cheaper way of irrigating large fields, as in alfalfa, so is the use of furrows generally cheaper in orchard and garden work of any magnitude. To handle a flooding

head on ten acres will take from two to four men according to its size, whereas one man can manage the furrows on ten acres if the delivery flume is fixed as it should be. I have known five acres of lemons furrowed, irrigated and cultivated by a boy of sixteen who lost not an hour from school, and the whole was well done. It was all in the arrangement being perfect at the start.

The first requisite for good irrigation from furrows is an irrigating head of from twenty to fifty inches of water for at least twenty-four hours for each ten acres. The head will vary with the nature of the soil, the product and the length of time you can run the water. Where the soil is quite close in texture and you can have the head for three days at a time twenty inches will do good work. I have seen fine work done with fifteen inches for ten acres, but it was with a four days' run, which gave plenty of time for the smallest

streams to soak the ground evenly. If you can get a run of only two days or a day and a half, you will need a larger head. Under some ditches you may not be able to get a head for more than twenty-four hours. Then you will need a still larger one, for you will have to use larger streams in the furrows and send them through more quickly to ensure full soaking of the lower end. If the run is so short that you have to use streams so large that they will run muddy or wash and cut too much, then you are at the point where it may pay you best to flood. For to do good furrow work the streams should run clear or very nearly so. If too muddy, they will puddle the furrows and check seepage, while the cutting of the soil and washing off of fertilizers in end-waste are disadvantages easily obviated in flooding and not sufficiently compensated by the

other advantages of furrows.

The nature of the crop will make a difference in the amount of head and the length of time you need it. Corn, for instance, will not need so deep a soaking of the ground as trees, although if you have plenty of water you are not likely to hurt it if the water is warm. So for many kinds of vegetables a run of two or three hours will do, and five or six will be enough for most any. Young trees will not need the whole ground soaked so that a smaller number of furrows may do, while such things as olives, that need little water, will do very well even when old and in full bearing without the centers between the rows being wet if a reasonable amount is run near the tree. In the East and other places where the rainfall is nearly sufficient, good enough work for most trees could be done with one furrow on each side, while two on each side should be enough for any. In such countries the shortage of moisture is generally in the top soil, caused by too long a delay in the rain at the time when the fruit most needs Consequently such deep soaking is not needed as in the very dry countries and a much shorter run of water generally will suffice. It is impossible to go into detail in these matters. From the analogies of a few cases the reader must work out other cases for himself; but for the dry countries twenty inches for twentyfour hours for ten acres is little more than enough for any kind of vines or trees,

alfalfa or other field crop irrigated with furrows and not enough for most trees

when old and in full bearing.

The number of streams into which to divide the irrigating head will also vary with the crop and the character of the soil as well as the size of the head and the length of the run. But if the soil stands the test described in Chapter VII of holding up small streams, the water is quite certain to soak well on each side. Hence, if you can give a long run, the smallest and most shallow rooted vegetation is likely to be wet enough at eighteen inches from the furrow and even on a ridge several inches above the level of the water eighteen inches away. On many soils a long run of water will not wet farther than this; and you need rarely feel any alarm at seeing the top of the ridge between the furrows remain dry long after the water has been running. If the soil will carry a stream of a gallon a minute at the rate of a yard a minute, the water will generally work up to the roots in time, no matter how high you make the ridge.

You may therefore feel quite safe in placing these little streams a yard apart for almost any kind of orchard or field crops. For many things, such as corn, four feet will do; that is, two feet from each row. On the other hand some garden stuff like strawberries that are great drinkers may do better with the streams two feet apart or even less. A few trials on a small scale will settle these questions and you should make them before you proceed farther in arranging the ground.

Suppose you have found that the right distance for your ground and crop is three feet apart for the streams. Ten acres are two hundred and twenty yards square. At a yard apart you would then have two hundred and eighteen streams. If the head of water were thirty inches measured under four inch pressure, as before described, which is about the average required for this kind of work, each stream would be a little over one-seventh of an inch or about one and one-third gallons a minute. Such a stream would need from fifteen to twenty-four hours to cross a square ten acre tract, or six hundred and sixty feet. It might do it in less or take even more according to porosity of the soil and the care with which the furrows have been made. At first it seems ridiculous to

think of doing anything with such streams, but you may be very much surprised when

you try them.

Nothing would seem more obvious than the need of uniformity in these streams to ensure uniform wetting, avoid cutting or filling, and furnish a uniform condition for cultivation. Yet the length of time it took to learn that furrows cannot be evenly fed from a larger ditch with earth connections, and the persistence with which thousands of irrigators still cling to such connections when lumber is cheap, are among the strangest things about the errors of irrigation. Bogs here and dry patches there are almost inevitable, unless you do a vast amount of flying about with hoe in hand. When you open laterals from the main feeding ditch, the earth at the junction is sure to cut away in some places and build up in others. In a short time one stream will be nearly stopped and another twice too big. The smaller the furrows, the worse this trouble, though it is bad enough with any. The streams are often stopped by a fallen leaf. I have seen a stranded beetle form a bar at the mouth of one in a few minutes and he was not an extra beetle either. The neglect to secure uniformity of flow in the laterals has been one of the most fruitful sources of loss in irrigation and has made many a one abandon the whole business in disgust.

Putting straw, brickbats, gravel or other similar stuff in the connection is simply recognizing the difficulty and then resorting to the stupidest way of avoiding it. Gates of some kind are so cheap, effective and permanent that in any well regulated State it should be indictable to try to get

along without them.

In some parts of California these streams are fed by hydrants placed at the head of each furrow. But these are a needless expense, and need considerable opening and closing at each irrigation to get the proper flow from them. In other places closed aqueducts of terra cotta with gates at every yard or so are used. are more of a luxury than the case requires. Wooden flume which can be made at home is good enough and is generally the cheapest material. Scores of miles of it have been in use at Riverside for many years and are perfectly good today. whatever is good enough for Riverside is good enough for any part of the world. If made of redwood it will last half a generation and most any wood well dipped in coal tar will do in most places. no law requiring you to put it under ground. You need not worry about the leakage caused by its drying between times. Throw a little fine dirt into it and fire a head of water down it and that is soon settled. With lumber at twenty dollars a thousand on the ground, and the owner doing his own work, a flume of inch lumber one foot square should not cost much over six and a half cents a running foot, as the braces amount to little where there is no pressure. This would be about four dollars an acre for a ten-acre tract, and the best investment ever made. It can be made smaller, but it is well to have it large enough, as it will be dirty and will not run full. Laid on a grade of twenty feet to the mile, it will carry the largest head you want for ten acres. Smaller ones will do where the grade is greater. If you hire the work done, it should not cost over a dollar and a half an acre more. In building it the grade may be kept well enough with a carpenter's level on a plank with a bevelled edge, or with a triangle of three strips of scantling and a stone for a plumb-bob. Or you can turn water into it and let it run as you lay it, as an Indian builds a ditch. Whatever it costs you will in a short time get back with interest compounded hourly, not to mention your prospects of heaven and good digestion caused by serenity of soul.

The gates in these flumes are often a wooden button over an auger hole. a plate of zinc about two inches square with a slide of zinc running in a raised portion on each side made by two slight cuts is better. Almost any tinker can afford to make these at two dollars and a half a hundred and less by larger quantity. But they can be made at home with old shears out of scrap zinc and be just as effective. Gates of this remain in position better than wooden ones of any form and when once set to an even flow need rarely be touched. The holes can be punched with a wad cutter and need not be over half an inch in diameter, though it is well to make them larger in case large streams should at any time be wanted. After the first regulation of these gates there is little to do but spend an hour or two each time you irrigate, looking over them to see that the streams are about uniform. Here

you may have to take out a little dirt or some leaves or other rubbish, but as a rule, you will have little to do.

As the head runs down in a flume from the discharge of water to the upper furrows, the gates will have to be opened wider. And toward the lower end it may be necessary to tack cleats across the bottom to throw the water out of the gate better. Some use brickbats, stones and such things, but cleats are better. It is best to put them on in the form of a button with a single screw in the middle so that they may be turned enough to give the proper flow with ease.

One of these flumes should be set for every face on which the water is to run. But if two faces meet like the ridge of a house, the water may be delivered from each side at once from a flume set at the top. The five-year old lemonorchard irrigated by the boy above mentioned was of this arrangement. The work is but slightly increased over that of a flume delivering from one side only, and if flume and gates are carefully laid and kept in order, the increase of work in this form is

hardly perceptible.

The advantages of this style of delivery are so great that it will probably pay to put in flume and gates even for flooding where the scale is not so great as to make the expense of flume over ditch too great. But for flooding on an ordinary scale, and for all furrow irrigation, no matter how large the scale, it is almost certain to pay. You may make your ditches ever so cheaply and put in box connections with gates at the divides, may have all the canvas dams or iron dams handy to turn the stream from one to the other, and then, when you have summed up all the running about you have to do looking after this and that, and all the cleaning of ditches, all the breakages from gophers, moles or other causes, all the loss of flow from growth of vegetation in the ditches, with other annoyances too numerous to mention, and balance them against the increased cost of a good flume and gates, you may find you have saved nothing in cash and are out a vast amount of time and patience.

The ground all graded to a face or faces of uniform slope and the flume in position, the next thing is making the furrows. These are often made with a common cornplow and are from three to five inches deep. Four will do for most things unless there is danger of water touching the stalk in some places. There is little danger in making them too deep. It merely is not necessary if they are made with The deeper they are, the harder they are to break up in cultivation. shallower they are, the more liable to break and let the water from one to the other. There is generally plenty of time to do this work and no excuse for slighting it. Every hour spent in making the furrows of uniform depth and as free as possible from heavy clogs, ridges or depressions, or openings into the next furrow will be well repaid after you start the water. These furrows are often made with a cornplow and sometimes with a cultivator. The latter may be easily fixed to make three at once if the ground is smooth and fine enough. It can be made at home of old beams on the principle of the cornmarker. If made long enough, it would make very uniform furrows very rapidly. But rapid work can be done with the common corn-plow and the boy of the family can do it as well as the grandfather who was raised to the plow. It matters not which way these furrows run. Running at right angles to the flume is but a matter of looks. But they should run on a course and slope that will carry the water as fast as possible without cutting the ground or making the water muddy. And they should always be as nearly parallel By walking along the as possible. flume at the head and looking down the rows you can compare them and see what they are doing much better when they are parallel.

(To be continued.)



THINGS THAT RETARD IRRIGATION.

By WILLIAM REECE.

FIRST—A conservatism that clings to old time customs, notions and superstitions, and opposes scientific researches and new methods of farming on the plains.

Cowboy notions still hold sway, and the ideas and efforts of all tenderfeet are looked upon with mingled pity and con-

tempt.

It is difficult to break away from the old custom of burning off the dry grass and weeds; plowing the ground about two inches deep; of letting the flood waters rush off to the rivers, and of keeping the wind pumps at rest, except when a drink is needed.

Some of the railroads give practical discouragement by their eagerness to grasp the profits from the improved business after individuals have, at their own expense, worked up enterprise and made the country more populous and productive.

A few persons have contributed valuable time and labor to study and advance the true theory of irrigation, without any idea of ever receiving any remuneration therefor, except as they may share the country's

prosperity.

Although railroads will receive the first and greatest returns from this enterprise, yet many persons have been compelled to travel at their own expense, to gather from actual observation reliable data by which the natural conditions and the best methods of farming this country may be fully presented to the public.

With the exception of irrigation and agricultural papers and journals, the press has given the matter but little promi-

nence.

Had as much space been given to irrigation in behalf of the farmers on the plains as was given to Corbett and Fitzsimmons, the country would be ablaze with enthusiasm in the great work of making the now barren desert furnish beautiful homes for many millions of American citizens who are now without homes and without employment. The so-called rainmakers have done much in the way of deceiving and misleading the people.

Money, labor and encouragement have been withheld from irrigation, and given to one of the greatest modern humbugs, that of rainmaking.

The aiding of this silly work by corporations has encouraged many farmers to

pin their faith to the rainmaker.

Educational journals, as a rule, shy off from irrigation as too earthly for the consideration of people of culture, and one educational journal in Nebraska is so far removed from things that affect man's happiness here below as to decline to give the matter of irrigation any recognition whatever in its columns. We think that teachers and preachers should not be so ethereal as to ignore those things that make people healthy, wealthy and wise.

Our congressmen have given the matter

comparatively little attention.

We do not know whether it is caused by indifference, by fear of being laughed at, or by fear of being censured by the politi-

cal press.

Ignorance of the meteorological conditions on the plains is another great hindrance to the onward march of irrigation. Men who never spent two years and in some cases never spent two days in studying and experimenting with the elements of earth, air, water, animals and plants are often loud in condemning or ridiculing what they do not understand.

We do not mention these hindrances in a complaining spirit. Railroad managers, editors, congressmen, teachers, preachers and farmers have a right to think and act as they please, but, lack of unity and lack of earnestness in this matter, nevertheless, greatly retards the development of the

arid plains.

The great mass of people seem to have given up all hope of reclaiming the great American Desert and are disposed to look upon the few who are firm in the belief that the desert can be made to blossom as the rose as a set of enthusiasts or land speculators.

What our people most need is scientific instruction in all matters pertaining to irrigation, and then concerted action throughout the length and breadth of the land.

Seasons of big crops are not, as is often

supposed, seasons of heavy rainfall,

The official records of Nebraska show that in 1883 there was a good crop, with fifty inches rainfall, while in 1889 there was a big crop with only twenty-three inches rainfall. The condition in Kansas affects crops in Nebraska. A few can take good care of themselves by local ditches, but, in order to make this arid region furnish comfortable homes for the millions of homeless American citizens, the atmospheric condition of the entire region must be understood, and the fierce thirst of the atmosphere prevented by dotting the plains with ponds and lakes, and by burying the wild and impervious buffalo sod with the Indian and the buffalo.

Our President and Congress and the daily press are all wonderfully exercised about a few barren acres in Venezuela and are rushing with break-neck speed to quiet the fears of people in Venezuela, but do not seem to care if the isolated settlers in arid America starve to death and the country becomes a howling, sandy desert.

A large majority of the settlers in arid America are men who spent the best years of their lives in defense of our country.

Congress encouraged them to settle on the plains but now refuses to do anything to make it possible for these settlers to live upon the land for which they paid the government millions of dollars.

If Salisbury would send a modern Stromburgh to run a line around arid America and claim what our government does not seem to care to develop, the natural resource of this fertile region would then be fully considered and appreciated and it would receive the attention it deserves.

Our government in conjunction with States, counties and townships must do one of two things, develop this arid country so that millions can have homes on small farms, or allow our country to fill up with troublesome and dangerous, homeless people.

The perpetuity of our free government demands that everything possible be done to encourage and aid our people to secure

Twenty acres under intensive cultivation will produce more than two townships now do without irrigation in Western Nebraska.

IMPOUNDING STORM WATERS.

By A. C. ROMIG.

OUR consecutive years of comparative drought and crop shortage have aroused the farmers of Central Kansas, as never before, to a spirit of inquiry and invention to discover some device by which like casualties may be averted in the future.

They are strongly and favorably impressed with Major Powell's suggestion of impounded storm waters by a system of storage reservoirs, catch basins, dams, and ponds, not alone for the purpose of irrigation, as he suggests, but for increased humidity, evaporation, heavy dews, and possible rainfall as well.

It is a well-known meteorological fact that clouds evaporated from the Pacific Ocean are precipitated on the western coast; in like manner, those of the Atlantic are spilt out long before they reach the center of the continent; that moisture from the great lakes of the north, and the

Gulf of Mexico on the south, seldom reaches beyond one hundred miles west of the Missouri State line, and that in all the vast territory bounded by the Missouri river, the Rocky Mountain range, British America, and the Gulf of Mexico, there are no inland seas nor large bodies of water exposed to the sun's rays for evaporation, hence the necessity of adopting the only available substitute in sight.

When the practice shall have become general throughout the watershed regions of the Missouri and Arkansas rivers, supplemented by the underflow lifted to the surface for the purpose of irrigation, as is now being done in Western Kansas, and if to this be added the additional supplement of deep subsoiling, the problem of relief and immunity from drought, hot winds and crop shortage, will be effectually and permanently solved.

IRRIGATION LEGISLATION.

RESERVOIR SITES WITHDRAWN BY THE GOVERNMENT.

BY CLESSON S. KINNEY.

THE needs and necessity of irrigation legislation which will definitely settle some of the vexed questions upon the subject of water rights are becoming more and more apparent in all of the Western States. In the face of this necessity appear great The law of vested rights difficulties. stands in the way as the greatest stumbling-block. If effective laws had been passed when the country was new, and the various rights which are now vested had not been acquired, the task would be easy. But at an early day the great needs and necessities of the future were not recognized either by the general government or by the various States. It is only by experience that some wisdom comes. In reviewing the legislation of Congress it seems strange that such definite and strict laws were passed relative to the acquisition of title to lands and at the same time let the element which is absolutely necessary to make those lands valuable, take care of This is the experience. The wisdom has come too late in many States. But be that as it may, the fact is that Congress is divested of the power to pass any general law that will govern the subject. It devolves upon the States to work their way out of the difficulty as best they can. That there are difficulties is illustrated by the Supreme Court of Nebraska declaring the irrigation law of that State unconstitutional; by the Circuit Court of the United States declaring the most elaborate law that was ever passed on the subject—the Wright law-also unconstitutional. many of the States the constitutionality of their irrigation law has not been tested. Several of the States have laws which are copied after the Wright law. All are waiting until the Supreme Court of the United States shall finally decide the question.

GOVERNMENT RESERVOIR SITES.

Some years ago surveyors sent out by the general government located a great number of reservoir sites throughout the inter-mountain country. These sites as located were withdrawn from the market so that they could not be entered by settlers and are still owned and held by the government ostensibly for the purpose for which they were located. They consist of natural depressions and basins, sometimes dry, but at other times are lakes of considerable size filled with water. The purpose of the government in locating these sites, according to the scheme of Major Powell, was for the government to construct at its own expense these reservoirs, and thus be enabled to dispose of its lands in the neighborhood of the same at a correspondingly higher price. This scheme was all very beautiful if it had been carried out; but when we come to consider that through all these years not a single reservoir located by the government has ever been constructed by it, another phase of the question is seen.

These sites which were located were of the very best that could be found. They are still held by the government, thus preventing their being located by private parties. The only reservoirs which have been constructed to date are those constructed by private enterprise. Many of the government sites would have been located and long before this the reservoirs would have been constructed had it not been for the obstruction of the government

location.

One of two things ought to be done. Either the government ought to carry out the original scheme and construct these reservoirs, or the law ought to be modified so that the sites could be located and reservoirs constructed by private parties. There is not much confidence in this western country that the government will ever construct them. But if the sites are opened up for private location the law ought to be so that they can only be located for reservoir purposes and not entered for farming purposes.

CORNERING THE CORN AND THE CATTLE.

A CRISIS IN THE CENTRAL WEST.

PRIVATE letters and dispatches from various points in the central Western States confirm THE IRRIGATION AGE'S announcement that a powerful company or a very wealthy individual was quietly buying up the great corn crop at ruinously low figures to hold it for a rise. It turns out that P. D. Armour, of Chicago, is the great buyer. Singularly enough the daily press know nothing of this as yet. Agents of Mr. Armour are working very quietly, but they are gathering in great quantities of corn. Elevators are leased in some localities, in others crib room is rented, and where this cannot be done cribs are built, and all the time corn is being shipped to Chicago, where Mr. Armour has elevators with storage capacity for 30,000,000 bushels. Never before in the whole history of the West was a solid corner on corn so nearly possible as at pres-This corn is bought at a price really below the cost of production, and far below what it will bear inside of eight The agents purchase at 15 cents per bushel, the farmers, who are in sore need of cash, readily selling at that figure. If Mr. Armour sells finally at 25 cents, it is seen that his profits will be immense, but it is more likely that he will hold for 50 cents. In case of a short crop in 1896 he may get 75 cents or more. Thus does the farming community fall victim to the money king. Instead of a fair profit, the farmers sell, per force, at a loss, while the great capitalist rakes in millions of dollars.

It was known that Mr. Armour was at the head of a syndicate to loan money to stock-raisers on their grazing herds, but this outright buying of the corn crop has been engineered on the quiet. The stock-raisers, like the general farmers, need cash just now and they are borrowing it freely, so that Armour will not only own the corn but he will also have a first mortgage on the cattle market. Of course there is nothing illegal in these operations, but it does seem outrageous that nothing can be done to defeat or check them. Such power in the hands of an individual

or a syndicate is most dangerous. It is often boasted that the farming and live stock interests, if no others, could steer clear and be independent of trusts, but the situation at present indicates the weakness of those boasts. Cattle, hog and even sheep raisers are all falling into the clutches of the combination, the free-wool Wilson bill being responsible for the hard times among the sheep owners.

A crisis has been reached in the affairs of the agricultural and live stock interests of the entire central West and the farmers of the whole country should unite in meeting it. It is idle to deny it longer. Times were never more desperate for central Western farmers than at present. Various crops, except corn, have suffered through drought, and the hog cholera alone has made ruinous inroads. All this being true, holders of corn and cattle are easy victims for the money kings. Cash must be had, and with offers of ready money, the corn is given up and the live stock is signed away. If ever there was a time for united action by the granges of the whole country, it is the living present.

As in Illinois, Wisconsin, Missouri, Iowa and Michigan, the operations of the cheap corn buyers have already been extensive in Nebraska, but there is yet time to succor many of the farmers. The Nebraska Farmer sounds the alarm and makes an excellent suggestion. It asks: "Is not a State, or a county, or a corporation larger than one man? In other words, cannot some system be devised for furnishing farmers with needed money, their bins of corn serving as collateral? By this means whatever of value is in the corn remains with the farmer and the community of which he is a part, and does not go to swell the millions of a man whose fortune represents and is measured by the losses of others. Such men would not be in the field buying up our corn if any adequate protection were provided producers. the people of the corn belt do not have opportunity to learn a useful lesson this year, we shall miss our guess."

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THE DIVERSIFIED FARM In diversified farming by irrigation lies the salvation of agriculture

CORN AND SOME OF ITS AS-SISTANTS.

[Abstractof address by President G. E. Morrow of the Oklahoma Agricultural College, before the Kansas State Board of Agriculture.]

NDIAN corn is America's greatest gift to the agriculture of the world. is the chief cultivated crop of the United States and of Kansas. The official estimates of the crop of the United States for 1895 give an average of more than 82,000,-000 of acres (more than one and one-half the size of Kansas) and a yield of 2,151,-000,000 of bushels, valued, even at present low prices, at \$567,000,000. The State estimates of the Kansas crop show an average of well over 8,000,000 acres, or one-half the total average in cultivated crops, and about one-sixth of the total area of the State, and a yield of 201,000,000 of bushels. It may help us to get some idea of the enormous quantity these figures represent if we recall the fact that the Kansas crop would fill a crib ten feet wide and ten feet deep and 900 miles long, or would make a tower covering one acre and reaching two miles into the air.

Corn is a true grass and we have underestimated its value by thinking too exclusively of its seed-not fully recognizing the great food value of the stalks and leaves. It is a conservative estimate that the value of these per acre equals the value of one ton of good grass hay. In the corn growing regions corn stalks may well be substituted for timothy or prairie grass hay. The silo admirably preserves the stalks or the entire plant. With the aid of the recently improved machinery for shredding the stalks they may be put into almost ideal condition, when it is not convenient to have a silo. Aside from the percentage of water, corn fodder has a chemical composition not materially different from that of the hay grass. The food constituents are digestible in large degree but the large stalks are not in shape to be readily eaten. Made into ensilage or shredded, this difficulty is largely removed.

Corn is long to remain the great grain food for American farm animals and will, probably, be more largely used as food for man in the future. Almost entirely new uses will be found for the grain as well as better methods of utilizing it for its present uses.

There is great difference in the value of different varieties—especially in their adaptation to different climates and soil. Much has been done in the improvement of varieties, but much more remains to be done. It is believed possible to develop corn so as to better adapt it to a dry climate than are the varieties we now have. Much experience shows the impossibility of corn having all good qualities in the highest degree in any one variety. For Kansas especially, those parts most subject to hot winds and drought, medium large varieties ripening as early as practicable seem best. There is much advantage in having the stalks of moderate height, with short joints, giving greater leaf surface.

In a greater degree than in some other regions early planting is important. Probably nowhere is thorough preparation of the soil before planting more important. Subsoil plowing will be helpful on much. Kansas and Oklahoma soil, largely because of its effect in enabling the soil to absorb and retain more moisture.

If anything has been proven by experimentation in regard to corn, it is that deep cultivation of the growing crop is generally injurious-especially after the plants have made much growth. Root turning is almost always a necessary evil at the best, and the less of it that is done the better. In dry seasons the roots are not so near the surface. No positive rule can be given as to depth. In Central Illinois three inches was found as deep as it was desirable to stir the soil in cultivating the crops. Were it not for the action of the strong winds, a level, finely pulverized surface is clearly the best.

The number of stalks per acre for the largest yields varies somewhat with the size of the mature stalk but probably more with the climate—decreasing as we go north. A regular, uniform "stand" is an essential to a large yield. Overcrowding is to be avoided but an insufficient or uneven stand is a frequent source of small yields. Probably from 8,000 to 10,000 stalks per acre may be a fair range for Kansas.

The food value of the crop increases until the plants are fully matured; the total dry matter increases greatly even after the stalks have reached their full size. There is some loss from winds

blowing off tassels and leaves.

Valuable as corn is, it cannot do everything. It needs assistance. We cannot afford to grow it year after on the same soil. A rotation is helpful in many ways. For much of Kansas alfalfa is an admirable crop both as a means for helping maintain the fertility of the soil and because of its great value as food. Whenever it will thrive it should be grown in increasing quantity.

Kansas and Oklahoma farmers are recognizing the folly of fighting against

nature's laws.

Eleven counties in the eastern fourth of the State grew more than one-fourth of the crop of the State. Twenty-four counties in the western fourth grew about one-fortieth of the crop—eighteen of these growing only about 1,500,000 bushels. For the regions with insufficient rainfall the sorghums, especially the Kaffir corns, give promise of very great value. One of the great fields for work for boards of agriculture and experiment stations in the regions of light rainfall is in improving the varieties and in learning how best to cultivate and feed this great crop of the future.

TRENCHING IRRIGATED LAND.

BY F. C. BARKER, NEW MEXICO.

TRENCHING is seldom practiced on irrigated land; partly on account of its cost, and partly because it is very little understood in this country. The European market gardeners trench their ground regularly every two years at least, and I am convinced that it would pay on all land where the crop to be raised is a valuable one. The operation consists in thoroughly pulverizing and

manuring the soil to a depth of eighteen to twenty-four inches, and it is needless to point out the great superiority of soil thus worked as compared with land manured and plowed in the ordinary way to the depth of, say, six to eight inches. Not only is there a much greater supply of plant food, but the loosening of the land to the depth of eighteen inches enables it to hold a greater amount of moisture, as every one knows who has tried subsoiling.

For the benefit of those who have never seen trenching done, I will briefly state how I do it myself, as the operation is somewhat different where irrigation is practiced from what is the rule on unirrigated land. In the first place the work should be begun as early in the fall or winter as the time can be spared, in order that it may be finished at least a month before the land is cropped. To begin with, cart onto the land barnyard manure at the rate of not less than sixty loads to the acre. Spread this and plow it under as deeply as possible. If necessary harrow or drag the land and then give it a good irrigation, so that the soil is moistened to the depth of at least two feet. Now leave the land for say, fifteen to twenty days, or until it gets sufficiently dry to work with the spade, and cart on sixty loads more of manure to the acre, depositing it in small heaps at a distance of about sixteen feet from heap to heap.

Having provided yourself with a sharp digging spade eleven inches long, proceed to dig out a space four feet wide and one spit deep along one end of the piece of land. Wheel or cart this soil to the other end of the land, as you will need it to fill up the You will now have a trench last trench. four feet wide and one spade deep, onto which throw manure, and having spread it dig up this trench one spade deep, mixing the manure with the soil. Then dig up another stretch four feet wide, throwing the soil upon that which was last dug. Now manure and dig the second trench and continue the process until you get to the other end of the land, where you will find the soil for filling the last trench. You will thus have the whole field dug and manured two spades deep. In actual practice I find that the first digging does not leave the trench over seven inches deep, as the spade on loose soil does not clear out all the earth, a good deal of it falling from the spade; but the second digging

goes fully eleven inches deep, thus leaving eighteen inches of well pulverized and manured soil, which would when finished be again irrigated, so that the manure is rotted before the crop is

planted.

As regards the cost, this will depend upon the texture of the soil and the class of labor employed. A man accustomed to the use of the spade will do fifty per cent more work in a day than a novice. I have employed native Mexican labor, paying them seventy-five cents per day and I find that when they get used to the work two men will trench an acre of land in twentyfour days, bringing up the cost to \$36 per This does not include the cost of manure, and the hauling and spreading of same, nor the first plowing.

Of course, only expensive crops, like garden truck, strawberries, and other berries, will pay for this intense culture. In the case of strawberries the farmer will take three crops off the land before it again needs trenching, and I think anyone will admit that land thus cultivated will easily produce 1,000 quarts per acre more than land treated in the ordinary way; or a total crop of 4,000 quarts instead of the usual average of 3,000 quarts. Reckoning the strawberries at five cents per pound on the vines you have a gain of \$150 per acre during the three years to pay for the cost of trenching.

On many soils it would pay to bring the bottom spit to the top and so have virgin soil in which to plant. The trenching is then done in the following manner: First, dig a trench twenty inches wide and eighteen inches deep. Then dig twenty inches wide and one spade deep and throw the soil into the bottom of the trench. dig the bottom spit of the second trench and throw it onto the top of the first In following this system of trenching, manure the top of the land as already described. This top soil will be placed at the bottom of the trenches and the soil brought up by the second spading will need manuring after the land is all This can be done by hauling trenched. the manure onto the land, spreading and plowing it in.

I believe it will pay to trench land for all crops like cabbage, cauliflower, strawberries, raspberries, blackberries, gooseberries, and currants, that need a very deep and rich soil. No deep plowing can in any way approach it. One hears of plowing ten inches deep, but take a foot rule and measure it and you will generally find only about seven inches of soil cultivated. Of course, cultivation with a plow, followed by a subsoiler, is much cheaper, but you will want four very good horses to stir the soil eighteen inches deep, and then you only have the top half manured, whereas by trenching you have eighteen inches of cultivated and manured soil.

IRRIGATION AND FERTILIZERS.

BY E. M. SKEATS.

ARMING under irrigation and farming in an arid climate with artificial water supply are generally synonymous, but the two phrases suggest distinct trains of thought. Very much has been written on farming under irrigation and its advantages have been eloquently set forth by many. The advantages are usually summed up in abundant sunshine, abundant water and therefore abundant crops.

But has experience in irrigated districts corroborated these claims? In a few instances no doubt it has, in more instances it has not, and why? Chiefly, I venture to say, because the peculiarities of an arid climate are not sufficiently recognized by the farmer from the rain belt.

Every district has its own peculiarities of climate, water and soil, but there are certain things common to nearly all arid

countries and these are:

1. Abundant bright sunshine.

2. An abnormally dry atmosphere.

3. Clear, cool nights with excessive radiation of heat into space.

4. Soil rich in inorganic plant food but almost destitute of nitrogen except in a few favored spots.

To make the most use of the sunshine the water and the inorganic riches it is absolutely necessary to supply nitrogen to its full amount. It is desirable to render the atmosphere more humid for most crops, and for many plants it is imperative to take the night radiation into account; any overshadowing will lessen this, such, for instance, as the proximity of a tree.

Time and diversified farming over large areas will do all we want, but we cannot afford to wait, and need not.

To get big results from the land chem-

ical manures have been tried by many with fair results, but with what a waste of money! All the constituents paid for except the nitrogen might generally have been dispensed with.

For arid lands, as a rule, good stable manure from animals fed on leguminous hay is by far the best fertilizer, and a liberal use of it by the first settlers is essential to full success.

Next to this the best results will probably be had by the plowing in of leguminous crops such as clover, alfalfa, cowpea vines, etc., and they should be plowed in in the fall and the ground kept moist

through the winter.

Every farmer, too, should so manage his farm as to have a leguminous crop come off all his arable land at least once every other year if possible, and he should take care to see that his very soluble nitrates are not leached out of his soil during the process of irrigation. he will find that heavy winter irrigation will go very far to prevent this. nitrates have not formed to any extent by then, and the water deep down in the soil will act as a supply for half the summer, rendering a minimum of irrigation necessary in the hotter growing months.

The humidity of the atmosphere may but be obtained by the planting of trees and covering the ground with crops. I think it will be found that with young orchards, especially in new districts, more and better growth will be had amid corn or other tall plants than in the open with clean cultivation. The moisture evaporated from the large leaf surface is accountable for this in great part. I need hardly add that the water evaporated thus into the air must be met by increased irrigation for the trees.

SORGHUM FOR SYRUP AND FEED.

BY MARY BEST.

MANY readers of THE IRRIGATION AGE have written asking for further information about sorghum, especially the varieties best suited for syrup. I am glad to be able to answer such inquiries as far as possible through the magazine.

Mr. A. A. Denton, who had charge of the extensive government station at Sterling, Kansas, has kindly permitted me to use any of his reports on this subject, and

I have also availed myself of the results gained at the station at Medicine Lodge. It is singular how little people appear to care as to what variety of sorghum they buy, and yet it is of the first and last importance to learn which kind is best suited for their purpose, and then, above all else, to see that pure seed alone is used.

I have been looking through the catalogues of several large seed houses and, while they advertise new and improved varieties of almost every other grain or forage plant, not one word is said about sorghum except the same old song. ber and orange" as special for syrup, and a general lump sum of "other kinds for This is the more remarkable when we know that any one interested can so easily learn from the reports that in the thorough and comprehensive work done by the U.S. Department of Agriculture "amber and orange" have been entirely superseded by Folgers and Colman, and that out of the hundreds of other varieties Collier alone stands equal with the two last named. The United States through the Department of Agriculture have spent an immense amount in the work of sorghum seed improvement and selection, not only showing how to accomplish this, but actually doing it on a scale never equaled, not even by the work in Europe on beet seed. Perhaps about no other plant in America is the information so complete and definite, or so little appreciated. may be that the very luxuriance of the plant, its ease of cultivation, and grateful response to a little care and attention make people careless and indifferent to the great possibilities under the best condi-

There is really little difference in the so-called varieties, being more agricultural than botanical. In 1888 there were many hundred different names; the whole work since then has been to select the best, discarding all others, and to improve the few In 1892, four varieties were acknowledged ahead of all others and especially desirable from a sugar standpoint for their quality of remaining true to parent feed. These were Folgers, Colman, Collier and Planter. The latter had no special advantages not embodied in the other three, and therefore has been dropped for general cultivation, as it lacked some of their virtues.

At Medicine Lodge and Sterling gov-

ernment stations and by private growers, it has been shown that Folgers is the best It has all the advantages of early cane. early maturation of amber, and is superior to it in every respect-in yield per acre, sugar content, and for syrup making. Mr. Denton, on being asked which is the best cane for syrup, replied, Folgers, for it is the one out of all others yielding a large amount of syrup that does not crystallize. While it is a week or ten days later than amber in ripening, yet in all tests of the two we have found one hundred days after planting it had an equal amount of sucrose.

Colman is a splendid cane. A cross between amber and orange, it is far ahead of either; it is firmly established and not only maintains the high standard reached, but improves from year to year. It is of great value for sugar, gives a large tonnage, and is a good resister of drought and frost, giving also a heavy seed crop. As a good cane for feed it is only surpassed by Collier.

The Collier is the third selected as being superior with Folgers and Colman to all others, and is recommended as the best variety for northern latitudes where sorghum is grown for sugar. Its sugar content is very high, and as winter feed it is simply perfection—tall, sweet and slender stalks, with an abundance of foliage which is resistant to frosts, and with the light seed heads stands up well even against our Kansas winds and calamity howls. It ripens early although a late cane and can be planted as late as June 15, and still mature. It gives a fine quality of syrup, which, however, very soon turns to sugar.

Wherever corn can be grown sorghum will flourish and will bear drought infinitely better. On the other hand we have a few acres planted on land irrigated a week before seed was put in, and this crop is still standing for the reason that the only way we could devise to harvest a forest of sorghum, was to turn in the cattle, and let them eat at leisure. No machine we have can cut it.

It looks as though the knowledge gained and money spent on perfecting this great plant was being rapidly wasted. Very few people are keeping their seed pure in this district. It is a thousand pities to have it all lost, for apart from the sugar question which is rapidly changing for the better,

as a forage plant alone sorghum is more valuable as it is kept pure and each variety grown separately.

SOILS AND PLANT FOOD.

BY H. R. HILTON.

[Extracts from paper read before the annual meeting of the Kausas State Board of Agriculture.]

PLANTS need food, like animals, and, like animals, do best on a balanced ration.

The essential elements of this balanced ration obtained from the soil are nitrogen, potash, phosphorus, lime, magnesia, iron and sulphur. If one of these is absent from the soil, or not in available form, the plant will be defective. If either nitrogen, potash, phosphorus or lime are absent, the plant will be short-lived. All of these elements are needed, and if one be missing, that one controls the life of the plant.

Assuming that all food elements required are present in sufficient supply, four important agents must still co-operate before the seed can germinate and the plant partake of the foods provided. These are heat, air, water and light. If there is a deficiency or excess of either one of this quartette, plant life suffers; if all are present in right proportions the plant reaches its highest perfection.

Each plant has its own requirement of heat, air and water, but when a fine textured soil has a temperature of 75° to 90°, F. and contains 20 to 30 per cent of its bulk of water, or 16 to 20 pounds of water to each 100 pounds of soil, and the air can permeate freely, it is in the most favorable conditions for the growth of our ordinary field crops.

The mineral elements of plant food are usually abundant in our western soils. Some, like potash, are most abundant where the rainfall is least, and least abundant where the rainfall is greatest.

Nitrogen, a product of decaying animal and vegetable matter in the soil, is the most costly, the most easily wasted or lost from the soil and the most valuable to the plant itself of all the food elements obtained from the soil.

Organic matter (i. e., animal and vegetable matter) in its various processes of decomposition in the soil is called humus,

The products of this decomposition are ammonia, carbonic acid and water. The agencies in this work are micro-organisms in the soil. The ammonia is converted by other micro-organisms into nitrous and nitric acid. The carbonic acid acts on the mineral elements of the soil and aids in rendering them more soluble and available to the plant.

The work of these lower organisms is important. German and French investigators have found from 500,000 to 900,000 germs in a gram of soil (less than half a

cubic inch).

These micro-organisms can only exist where organic matter is present and will be many or few as organic matter is abundant or scarce. They are dormant when the temperature of the soil is below 39° F. or above 115° F.; dormant when the moisture content of the soil falls below 8 to 10 per cent, or about one inch in depth of water to one foot in depth of soil; dormant when the soil is fully saturated with water and dormant when air is excluded either by too much water in the soil or by soil compaction. They are most active when the soil is about half saturated, i. e., from 20 to 30 per cent of the bulk of soil, or say 16 to 20 pounds of soil, and when the temperature of the soil is 75° to 90° F. and the air has free access to supply oxygen.

Many farmers consider the destruction of weeds the important object of cultivation, but this is secondary to the maintenance of those favorable conditions in the soil that will secure the presence of air, water and heat, so related as to promote the highest development of the plant.

In applying stable manure to the soil organic matter is being supplied for the bacteria to work upon, and to get the most value out of the manure, soil conditions favorable to the nitrifying processes must be maintained or much of this valuable promoter of fertility will be wasted.

We have little control over the temperature of the soil, except as it is warmed in the early spring by cultivation, or lowered at mid-summer by shading the ground with green foliage. Our soil temperatures are not excessive even in mid-summer if a corresponding proportion of water is maintained, but a deficiency in the water supply makes a lowering of the soil temperature desirable while the deficiency exists.

The air is always within reach and available when the soil is in permeable condition.

Time to Irrigate.—When to irrigate is a serious problem with many, especially so with new settlers. To lay down an inflexible rule for irrigation would be absurd. One answer is, to watch the appearance of the crop and give water as the condition demands it. Root crops will thrive best if irrigated frequently. Corn when small should have but little water, quite frequently none until it is several inches high, but when it is earing out it will require a great deal of water. This is true of all crops when the grains are filling out and the most rapid growth is being made. The water should be shut off when the grain is hardening.

To allow water to stand about the plants with a hot sun shining on them is often fatal. Cabbage and even alfalfa in some soils can be killed in this way. The application of water to growing crops is a matter that requires a great deal of inves-There are so many conditions to tigation. be considered and different objects to be accomplished that comparatively little is known as yet of this science. Both quality and quantity are regulated by the use of water; then what is best in some soils is not good in others, so that the old timer even finds new difficulties to contend with when he changes his location, even though

but a few miles away.

Winter Water Reservoirs.—The winter rains and snows are a constant source of waste of water that might be held in natural basins or easily constructed reservoirs for use in irrigating during the coming season. There is no better time than the present for irrigators to investigate the subject of securing an independent source of water supply. Land without water is almost worthless in many sections of the West, yet with a sufficient supply to meet all the demands for irrigation the land becomes valuable in proportion to its location and fertility.

If the soil is of a character to admit of constructing catchment reservoirs every available location should be used. In the foothills of most mountain valleys are basements covering from one to fifty acres where, with a little work, a large body of winter water can be stored. Small channels, made with an ordinary plow, will be sufficient to lead the water from a large area to the reservoirs. In this manner the rains, that otherwise would only swell the mountain streams and run away causing frequent floods and destruction of property, can be utilized and made to furnish moisture for the next season. The snow is a prolific source of supply for these reservoirs, and many small streams of winter and early spring can be trained into the channels leading to the reservoirs.

The Woolly Aphis.—Cyrus Marshall, of San Marcos, California, gives this remedy for the apple tree pest as follows:

"Some six years ago I found fifteen or more apple trees infested with woolly aphis. The trunks were more or less covered with them and they had distributed themselves on the higher branches on most of the trees. I had a mixture, kerosene, of course, being the principal ingredient, and applied with a very small brush to the parts affected. As fast as I killed them they came up to the roots and appeared again upon the trees.

I consulted all the men I saw who were learned upon the subject of tree pests, and received from each a remedy, none of which was a success. The second year, after vainly working, I dug deep around each tree and found masses of diseased roots attached to the main roots, woven together in labyrinth, and from three to four inches in diameter. In the interstices were thousands in different stages of development. I cut these diseased masses of roots clean from the trees, and put around each tree two or three gallons of hard-wood ashes, and then filled up with the earth. not necessary to repeat the experiment, except with five or six trees, and did not lose one, and have since had no woolly aphis."

When trees stand too thickly in grown orchards, excluding air and sunshine, all inferior trees should be dug out. Each tree to bear well should be exposed to the light on all sides. Many a cord of wood might be taken from most orchards and yet plenty of trees remain to serve their purpose better. Remove all rough dead bark from the trees with a scraper, and

whitewash the body of the tree nearly up to the limbs. This destroys all insects, the bark will be renewed and the whole tree restored. The scrapings, however, must be burned or the pests will live on the ground. This work can be done any time during the winter.

Our Poultry Population.—No account was taken of the hen product until the census of 1880, when it was found that we had approximately 100,000,000 fowls in the United States, laying nearly 457, 000,000 dozen eggs. During the subsequent ten years the number of fowls had more than doubled, though the increase in the egg product was not so great, doubtless because of the greater consumption of broilers. The exact figures are as follows:

Census.	Fowls.	Geese, ducks and turkeys.	Doz. eggs.
1890	258,472,155	26,816,545	817,211,146
	102,265,653	23,234,687	456,875,080

Increase. 156, 206, 502 3,581,858 360,336,066

The increase in the number of fowls was 153 per cent between 1880 and 1890, and of eggs 79 per cent. Estimating the value of eggs at 12 cents a dozen on the farm the year through, we would have the egg supply of the United States worth \$55,000,000 in 1879, and \$98,000,000 in 1889.Taking the farm value of a fowl at 25 cents, we should have \$64,618,039 as the representative value of all American Adding this to the \$98,000,000 for eggs, we get \$162,618,539 as the value of the fowl crop of the United States. This is 150 per cent greater than the value of all American sheep in 1895, and \$62,000,-000 greater than their value in 1890.

One Acre, with Irrigation.—The following is a closely estimated average of crops raised on one acre in Otero county, Colorado, last year: Wheat twenty-six bushels, oats thirty-seven bushels, rye thirty bushels, barley forty bushels, corn forty-one bushels, beans twenty-two bushels, potatoes 160 bushels, sweet potatoes 110 bushels, peanuts 150 bushels, tomatoes 325 bushels, sugar beets twenty-two tons, alfalfa five tons; cabbage, sold at two cents a pound, eight tons, cantaloupes, sales for an acre, \$248.30, net \$203.20; watermelons, sales for an acre,

LEGISLATION THAT IS URGENTLY DEMANDED.

THE National Grange, various State Granges—among them the strong Illinois body-and the Illinois Farmers' Institute, all recently in session, demand from Congress and the Illinois and Indiana State Legislatures pure food laws—laws which shall suppress the manufacture and sale of bogus butter, bogus cheese and bogus And the National Dairy Union, which has just closed its session in Chicago, voices the same just demand. Committees were chosen by the Union to wait on Congress and the Illinois and Indiana Legislatures. Other Western and Central States, except Illinois and Indiana, already have State laws to protect honest products.

The attention of Congress and the Illinois Legislature is also called to the fact that a great and extensive business is done in Chicago in horse meat—sold as beef. The stuff could be seized in hundreds of meat markets at any hour any day. Horses are not only slaughtered here but supplies of corned horse are received from western points in barrels and cans.

Another meeting, with more credentialed delegates than there are to a national political convention, has also just been held in Chicago. This was the first annual meeting of the National Association of Manufacturers. About 15,000 people were in attendance, representing manufacturers of the country worth hundreds of millions of dollars. A national organization of the manufacturers was cemented, and that great organization proposes to have a voice in regard to future legislation concerning the manufactures, trade and commerce (domestic and foreign) of the United States. Its very reasonable demands for the present will doubtless be granted by this or the succeeding Congress.

THE far Western States are waiting on Congress for an act giving them the arid land grants outright, and the Territories ask to be included in the measure. A Government Commission for the regulation of irrigation water supplies has been recommended by Commissioner Lamoreux. Western America is also waiting on the United States Supreme Court for a decision of the constitutionality of the State District Irrigation laws.

The commercial bodies of the country demand a much more thorough recognition of the business interests by the government, and the bill in Congress for the establishment of a Department of Commerce will doubtless be pushed through. The head of the department will be a member of the Cabinet. It is suggested that the scope of the new department should be extended to embrace a general supervision of the tariff.

Members representing \$100,000,000 worth of lake vessel property attended the annual meeting of the Lake Carriers' Association at Detroit. Congress was memorialized against the proposed railroad bridge over the Detroit river, and in favor of deep water in the connecting rivers and canals. The proposed bridge at Detroit was denounced as a scheme of the new railroad trust to cripple the lake shipping and retard quick shipments by water.

THERE is nothing preposterous at all in the demand for free rural mail delivery. It can be performed cheaply enough by postmen on horseback or on bicycles. Every agricultural paper in the country should advocate this proposed measure, so that farmers may receive their papers soon after they reach the country postoffice.

FARMERS are crying out for the seed distribution, and a bill is to be introduced forcing Secretary Morton's department to furnish them. That investigation of the Agricultural Department will bring out a long list of complaints.

MANUFACTURES AND TRADE

Delegates to the first annual meeting of the National Association of General Manufacturers, just held in Chicago, represented an invested capital of \$2,000,-000,000; while the delegates to the meeting of the Textile Manufacturers' Association of the West and South represented an invested capital of \$40,000,000. latter includes both woolen and cotton interests. These two great associations held separate meetings, with one joint session. The common aim of both is protection to home industry and extension of American trade to foreign nations, and the Textile Association adopted ringing resolutions for Congress on that subject.

The general manufacturers' meeting called the attention of Congress to the fact that Japanese goods are flooding the American market, and called for a halt. report of the committee on resolutions, which was adopted, asked for a uniform classification of freight from the Interstate Commerce Commission. It also advocated the establishment of an industrial exposition in the City of Mexico; that a Department of Manufactures be established under a secretary of equal rank with the Secretary of Agriculture; that the inequality of traffic conditions in various States be investigated and righted if possible, and that the Senate of the United States is earnestly requested to pass promptly and send to the President the revenue bill lately adopted by the House of Representatives. The meeting was unanimous for the completion of the Nicaragua canal. Trade agencies in South America were de-

The speech of Hon. Wharton Barker, of Philadelphia, before the Textile manufacturers, was a great feature, and was closely followed. He urged that protection and bi-metallism must accompany one another.

A decision of various points in the Interstate Commerce Act has just been made by the United States District Court in Chicago in ruling on the Santa Fé and Nelson Morris indictments. The big packer was freed from his troubles, the indictments relating to him being quashed.

John A. Henley, traffic manager of the Santa Fé, and ex-President Rinehart of the same road were adjudged to have been properly indicted. The indictments against Isaac Thompson, a Kansas City shipper, and Manager Jenkins of the Hammond Packing Company were quashed. The court holds that a shipper cannot be punished for accepting a rebate, but that it is right and proper that carriers be held for discriminating against the public. The railroads of the country will take the general issue of the law to the United States Supreme Court.

VENEZUELA has just taken her first step in commercial warfare against England. George Turnbull, of Boston, who claims part ownership in the great iron mines in the Imataca mountains, not far from the mouth of the Orinoco, and within the territory contested by England, started from Great Britain with a ship load of mining machines and material which were consigned to a firm in Ciudad, Bolivar. At that place, when he offered to pay the duty on the machines, he was told that he had violated the law in not going to the point originally appearing in the manifest. He was further informed that his act was regarded as an invasion of Venezuelan territory and that it was probable that his machinery would be confiscated.

THE concensus of opinion among wellposted men is that prices of cattle and hogs will show quite a gratifying advance during the next sixty days.

An International American bank was one of the recommendations of the Pan-American Congress and was suggested by the late James G. Blaine. A bill for such an institution is now being considered in Congress.

While general trade has not shown a widespread tendency to revive from the holiday depression, there are favorable features in a revival in iron and steel prices, and continued heavy cereal exports.

"PATRONIZE home dealers" is the motto being generally adopted in the

termined upon.

towns and cities of the Western States. In other words, dealers agree not to buy from people outside their city and their State anything that can be bought (reasonably) at home. It is State protection of home industry and home products. If outside cities and States are real good, sales will be made to them.

The annual meeting of the Lumbermen's Insurance Company and the Northwestern Lumbermen's Association was held at Minneapolis, with 350 delegates. The insurance company has a surplus of \$4,000. J. A. Smith, of Osage, Iowa, was elected a director in place of W. H. Robinson, of Mayville, N. D. In the lumber association there are 905 great lumber yards. President Tuthill (of South Dakota) spoke for arbitration of claims between wholesalers and retailers, and urged that the reciprocity scheme between large and small lumbermen be put into effect.

The Illinois Farmers' Institute had a successful meeting at Springfield. The papers on agricultural topics were of a character to lead farmers into lines of valuable thought. The officers elected were: President, F. M. Palmer, Clinton; vice-president, W. E. Robinson, Greenville; secretary C. F. Mills, Springfield; treasurer, T. W. Wilson, Springfield; superintendent of institutes, C. F. Mills, Springfield.

Gold held by the National banks of the United States is \$165,000,000. Of this, the National banks of Illinois hold one-eighth—\$20,000,000. New York banks hold \$50,000,000.

A GENERAL convention of the Southern cotton growers, held at Memphis, resolved to reduce the area of cotton planting. They will use the spare acreage for corn and other crops. If India, Egypt, Argentina, Polynesia, and other countries rush their cotton in here, they will simply ask for protection.

A strong company has been organized to work the Indiana oil fields and crowd the Standard Oil Company out.

Apparatus "for running a farm by electricity" is what Israel Hogeland, of Chicago, insists he has invented. Instead of a network of trolley, an insulated wire long enough to reach across the fields to

be worked is all that is required by the new invention. The motor can, of course, be attached to an innumerable number of farming implements.

A MEMORIAL has just been forwarded to Congress by the National Live Stock Exchange asking for legislation looking to reciprocal trade with foreign countries.

THE National Dairy Union elected officers as follows: President, W. H. Hatch, Missouri; vice-president, J. E. Keith, Illinois; secretary, D. W. Wilson; treasurer, G. W. Linn. Chicago Produce Exchange Committee on legislation: W. H. Hatch, Missouri; James Hewes, Maryland; H. C. Adams, Wisconsin; W. K. Boardman, Iowa; George M. Whittaker, Massachusetts; E. F. Webster, Ohio; J. E. Keith and G. W. Linn, Illinois; W. A. Hudson, St. Louis, and H. C. Christian, Wisconsin.

Officers of the Union Stock Yard and Transit Company this year are as follows: Nathaniel Thayer, president; John B. Sherman, vice-president and general manager; J. C. Denison, secretary and treasurer; James H. Ashby, general superintendent; Richard Fitzgerald, superintendent of Transit Department.

The demand for export sheep is not as good as it was a few weeks ago when prices were forty to fifty cents lower. There has not been improvement enough in foreign markets to warrant extensive shipments at the prices. However, much space has been engaged by sheepmen, and they will have to fill it or sublet it to cattle shippers.

Secretary Smith, like Secretary Morton, opposes everything at all in the interest of, or for the relief or advancement of, the West. He is now fighting the Free Homestead bill before the House committee on public lands.

Several Chicago, Duluth, and Minneapolis vessel men and shippers have concluded to make their through rates to Europe sure and uniform, and they are buying steamers for an ocean line from Boston to English and German ports.

Frank E. Wagner, elected secretary of the National League of Commission Merchants of the United States, is a member of the commission firm of G. M. H. Wagner & Sons, of South Water street, Chicago,

THE PROGRESS OF WESTERN AMERICA E

A MONSTER COLONY FOR NEW MEXICO.

BY HORATIO.

EVERY city and town in the United States today has idle people. Chicago has 30,000 men who cannot get steady employment, for the simple reason that every place is filled. These people are not drunkards or loafers, and many of them are skilled in the trades. The typesetting machines alone have thrown half a million printers in the United States out of all chance of further employment at their trade, and before the machines came the electric lights had rendered many of them half blind. The condition of the printers today, most of them with families, is indeed pitiable. The Western State or Territory that wants population, and wants to advertise itself at the same time, can secure a monster colony by giving each ex-printer a small tract of land, with the privilege, in the future, of buying additional acres.

The men who are in the sorest need are newspaper compositors, and The Irrigation Age feels sure that once the suggestion is made the newspapers of the West will take it up. We ask the press to aid us in founding a printers' colony, and thus succor half a million as good men as tread

God's green earth.

That such a colony would rapidly fill up goes without the saying, for printers all over Europe and all over the world are in the same sad predicament as those in this country. From long service and night work, hundreds of these men are worn down and weak, but they will rapidly recuperate. If a companion is necessary, the American printers today are in much worse condition than the Armenians, and these men and their families are Americans, and are the wards of, and made, the newspapers which now do without them.

Will New Mexico do itself honor and at the same time perform a national charity by offering homes to these suffering people?

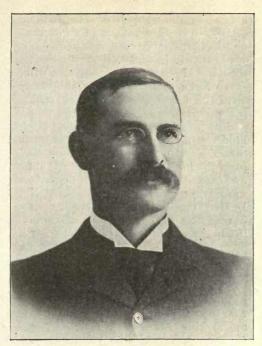
Communications on this subject from Territorial and State officers, or Territorial, State or County immigration bureaus can be addressed to The Irrigation Age, Leading men in printers' societies in Chicago, St. Louis, Cincinnati, New York, Memphis and New Orleans, agree that such a colony as is suggested, would prove a blessing, and they are enthusiastic to push the suggestion to an established fact. If our friends of the western press desire to know the feeling among the fraternity all through the West, let them step into the composing room and "sound" the "subs" that are standing around, or send reporters to the headquarters of the Union or other printers' societies.

If a favorable offer is made by New Mexico, or some other Territory or State, The Irrigation Age has arranged to immediately place it before meetings of the printers in every city and town in the United States, and such a noise will be made that it will be heard all over Christendom.

But the terms must be awfully easy. It must be remembered that most of these men have been without employment for a long time; that close application to type-setting for most of their lives from boyhood up almost unfits them for other city employment. These men are poor now, through no fault of their own, but if given a chance they will quickly become much more than self-sustaining.

And, without reflecting at all on gentlemen who make a business of colonizing, we wish to have it understood that in no way can there be any money in the project for The Irrigation Age. If offers are received of homes for these deserving and desirable people, those offers will be immediately turned over to the printers' societies. Our services are free, gratis, for

nothing.



PROF. L. G. CARPENTER,
of Fort Collins, Colo.
Whom the Government of France honored with the decoration of Chevalier du Merite, Agricole.

PROSPEROUS TIMES FOR 1896.

BESIDES the usual spring flow of immigration to the far Western States and Territories, the coming season will witness the arrival of small armies of men to work in the gold mines. Capital has been attracted to these rich mining regions, and the diggings will be worked during 1896 as they were never worked before. This increased population must be fed, and there will be such a demand for supplies that more agricultural lands will be in request, and they, in turn, will be worked for golden crops.

An era of increased prosperity seems to have begun for this Western country that cannot be called a mere boom. It will be lasting and enduring, and all the industries will be built up while the work of mineral development progresses. Colorado will make further great strides during 1896, and her sister States will also push ahead. Investors in mining lands seem to be investigating the chances in all the States and Territories, and to be making choices in regions widely separated, and, for every mining district

worked, hundreds and thousands of additional acres of land will be opened up to agriculture through irrigation. Utah, as a State now, will forge ahead to even greater prosperity than at present, and she already has much to boast of. Out of more than 20,000 farms today, only 2,000 are in any way incumbered. Nine out of every ten Utah farms are clear of mortgages. And as to the richness of Utah's mineral resources, there is no need to speak just now. New Mexico, Arizona and Oklahoma, have made such strides that their showing gives substantial foundation for their demands to be admitted to the Union as States. new State of Washington has made unprecedented advances.

Irrigation has made Western America. It is the bountiful crops on former arid lands, through irrigation, that have attracted attention of late and made more thorough mineral development possible, and the mineral development, in turn, will aid irrigation to continue its grand march in quickened measure. The assertion is made that during 1896 Nebraska will have a million acres of land under irrigation

In pursuance of the general plan of the Northwestern Immigration Bureau, organized at the St. Paul convention, of which Washington and South Dakota are members, the two latter States have just held full and enthusiastic conventions and organized State bureaus, with branches in every county. North Dakota, Minnesota, Wisconsin, Montana, Oregon, Idaho and Manitoba, also members of the Northwestern Bureau, will take similar steps.

Wyoming did not make great headway during 1895, beyond her heavy coal production, but during the present year the prospects are that more gold and silver will be brought out. The depression has been seriously felt in her immense wool interests, but the righting of the protective tariff will eventually remedy all that, as it will also for the same interest in all The cattle industry in Wythe States. oming is a leading one, and the agricultural area is being much extended by bringing water upon new lands. Idaho has steadily advanced in mining and agriculture, and immense areas of arid lands are just now being opened up through irrigation. Montana maintained her old prestige in 1895 as one of the great mining States of the world and her agricultural advancement has also been great.

Nevada, for many years the leading mining State of the Union, will push forward again when transportation is cheapened, and when labor is adjusted on the scale of other States. During the past year an immensely rich gold district was opened up in the southeastern part of the State. Nevada's wool interest, which is very great, has been sadly crippled during the past three years of tariff insanity, and another of her great industries, that of horse raising, has been practically killed by the fall of the price of all ordinary animals of that breed. But good times will come again for Nevada.

Of California, like Utah and Colorado, and some of the others, there is hardly need to speak. She is still taking out gold, and her fruits and vegetables are everywhere to be seen. Texas is going into irrigation on a large scale and is becoming a great agricultural as well as a

stockraising and mining country.

With her enthusiasm for irrigation, Kansas is going forward like a racehorse in agriculture, and she has got another new wrinkle. This time it is oil.

MANUFACTURES IN THE WEST.

T is evident that the great woolen mills of the future will be in the West and Southwest, where the wool is grown, and that the East will lose the cotton manufactures in favor of the South and Southwest, where the cotton is grown. withstanding the disastrous free trade of the past three years, several immense woolen mills have been completed in the far Western wool States, and, with a resstoration of protective dúties, a great new industry for this section will spring into Beet sugar has also come to stay. This industry will be given protection, and the acreage in beets and the number of sugar factories will increase in a more astonishing way even than during 1895. The quantity of sugar produced from beets in the United States is already greater than that produced from sugar cane, a fact not generally known. Tanneries are also increasing in number and these will be protected by the duties on leather. deed, the West and Southwest have come to see that a high protective tariff is necessary along the whole line. Those Mexican cattle will be shut out, and so will timber and lumber from across the line. Liverpool salt will be taxed out, and the salt industries of Utah, Wyoming, etc., will be given a chance to revive by the demand from the increasing number of packing-houses, creameries, etc.

Starch-making is now becoming a great industry in the Western and Northwestern States, great acres of land being sown to potatoes for the sole purpose of starchmaking. Twenty new starch factories were in operation in Minnesota, North Dakota, South Dakota and other States during 1895. The number of canneries in the great fruit States was also largely augmented. It is postively stated that syrup can be manufactured from common corncobs and this will also be a new industry.

The Oscar Lake Syrup Association, near Alexandria, Minn., have a good outfit and are making a first-class article of syrup from sorghum and the yield goes about

170 gallons to the acre.

The completion and successful operation by the great flour-mill owners in Minneapolis of one of their mammoth mills at Great Falls, Montana, is a signal that the bread-producing region is moving westward. Of course, before a great firm of that kind would build a costly mill away in the interior, they calculated all the chances. To the amount of wheat which Montana can raise there is hardly any limit, and not many people realize how great a State Montana is, or what its slumbering resources are capable of producing. It is a better range State than Texas. is one of the foremost mining States. And, if need be, it can be one of the first grain States in the Republic—that is for wheat. oats, barley, etc.

The contract recently made by the Oregon Railway & Navigation Company, making its line of steamers to the Orient permanent, insures a great trade in Oregon's flour with Asia. The manager of one of the leading flour mills of the State says their flour trade with Asia has doubled twice within the past three years, and he is confident it will be doubled again within three years. The arrangements at present are sufficient to handle 4,000 tons per month, and in two or three years at farthest, two steamers per month will be needed, instead of one, and the possibil-

ities of the trade in ten years no one can

even approximate.

The hundreds of lumber and shinglemills of Puget Sound are now in active operation, in spite of the apparent advantage of British Columbia mills in supplying our market, -which indicates that the American lumbermen either overestimate the advantage the Dominion government gives its loggers, or that the demand is great enough to prevent this advantage from closing American mills. The foreign demand for "Oregon pine," which means Washington fir, is good, and the harbors are full of ships awaiting cargoes for China, Japan, Hawaii, and the South American as well as South African ports. The output of shingles is heavy, the profit depending much on the experience and economy of the manufacturer.

NEW IRRIGATION ENTERPRISES.

P. SHELBY, assistant general traffic manager of the Great Northern, and other citizens of Seattle have organized a company for the purpose of developing the large waterless area along the line of the Great Northern between Wenatchee and Spokane. The plains stretching out in that region comprise more than 100,000 acres of land that is in every way desirable for farming, save that it has not an adequate water supply, and this supply is to be obtained by sinking artesian wells.

Following out the same general idea, still another company has been organized, with John D. McIntyre at its head. This company will operate in the neighborhood of Adrian, twenty five miles further east on the line of the Great Northern, or 225 miles east of Seattle. The plan of this company is to put in a canal which shall gather up and utilize the water from Crab creek and several other creeks in the vicinity of Adrian.

An irrigating enterprise is being inaugurated at Strumpp's Rapids, six miles above Pasco, Wash., in the Columbia river, by J. E. Vangordon, Edward Clarke and J. C. Stelm, all citizens of Pasco and vicinity. They will irrigate

1,000 acres.

The first application for the setting aside of arid land to be redeemed under the Carey act in Idaho has been made by a big Wisconsin company, of which Charles

T. Palmer is president. The company has located at American Falls, on the Snake river, near Pocatello, and asks to have 100,000 acres set aside for reclamation under the Carey act. They propose to settle the entire tract with colonists, who will pay but fifty cents an acre for land and cost of water rights. The cost of irrigation works is estimated at \$200,000.

Secretary Smith, at Washington, took up and considered the bids for the irrigation work at the Fort Hall Indian reservation. He considered all the facts presented by the Commissioner of Indian Affairs, and his final conclusion was to authorize the commissioner to enter into a contract with the Idaho Canal company to construct the works at their bid of \$90,000 according to the government specifications.

The American Falls Irrigation & Power Company have applied for the control of 109,680 acres of land, located on Snake river, in Blaine county, Washington. The company proposes to take the water from Snake river, and carry it to the east to reclaim a large section of land that is now a desert waste. Another irrigation enterprise is to be put in next June, near Lewiston, Idaho. The company expect this project will cost \$10,000. This water will be procured from Asotin creek, and will be 1,000 miners' inches and when needed will be increased 2,000 miners' inches.

Wyoming papers say Chicago and Eastern cattle kings are conspiring to get hold of the 1,000,000 acres of land granted to the State under the Carey law, to the exclusion of the numerous small cattle owners and sheep owners, and every other industry. It is said that the cattle kings expect to get these lands under leases from the State.

Arthur P. Davis, hydrographer of the Geological Survey, has been detailed as an expert, at the request of the Indian bureau, to investigate the water supply and to plan a system of irrigation for the Gila River Indian Reservation, in Southern Arizona.

Several towns and cities in Oregon and Washington have lately obtained an excellent and adequate water supply in an inexpensive manner by the use of wooden pipes. The pipes are made from common pine logs, ten inches in diameter, hollowed out with a six-inch bore. It is claimed that the wooden pipes last as long as the iron pipes. One town has a line of pipes seven miles long that, with all connections, cost but \$2,000.

Additional artesian wells are being bored in many parts of North Dakota, the water to be used for irrigation purposes. The city well at Mayville flows 9,000 barrels every twenty-four hours, and has already filled up a large lake in the park, the overflow going into Goose river.

Irrigation is making more rapid progress in Northwestern Texas than in any other part of the plains country at this time. Texas was one of the last to begin to experiment with irrigation but she has a wonderful supply of underflow waters and there is destined to be, within a very few years, some rich developments in agriculture in what has been almost a desert.

POSSIBILITIES OF BEET SUGAR.

That the people of Nebraska appreciate the value of the sugar beet is indicated by the fact that arrangements are complete for a State Beet Sugar Convention, to be held at Lincoln within a few days now. The Salt Lake Tribune says: "The wires tell us that Russia last year had under cultivation 814,419 acres of sugar beets and that the yield was 717,558 tons of sugar. That at 3 cents a pound gives Russia over \$40,000,000. Could that sugar have been raised in Utah, it would have been worth something over \$70,000,000. We do not need that much for Utah, but there is no possible sense, so long as this country is filled with idle men, in paying \$100,000, 000 annually for foreign sugar. It is a sort of impeachment of our own intelligence."

Alameda county, California, did a very fair season's work in beet sugar, the quantity turned out by the sugar works at Alvarado being 5,400,163 pounds; tonnage of beets worked, 27,385. Acreage for next

season in the county is 3,550.

The Chino Champion re-asserts that the average price paid for Chino beets last year was \$4.30 per ton; but the detailed figures of yield and amount paid for the whole, as given by the Champion, do not show that the price averaged above \$4 per ton.

Sugar was a somewhat short crop taken as a whole in 1895, compared with 1894. The total production for 1895 is estimated at 7,117,700 tons, of which 4,000,000 tons

are beet sugar, showing that the beet industry has already surpassed that of cane in the sugar output of the world. The shortage from 1894 is estimated at 1,225, 000 tons, and 265,000 tons below the crop of the previous season.

> Professor Hilgard of the University of California announces that there is absolutely no difference in the sweetening power of sugar made from sugar cane and beet

root.

BIG OIL FLOW IN KANSAS.

The Standard Oil Company having purchased the Kansas oil fields, they are to be worked to their full capacity. from Neodesha, in Southeastern Kansas, "The historic days of Oil City, Pa., are to be repeated in sunny Kansas. the first of next week a still larger force of drillers will be on the ground and will average a rig a day until more than 200 new derricks will be added to the 120 now Besides these forces of the standing. Standard Oil Company, the Geiser Oil and Gas Company will soon have drillers at work, and, as stated by one of the companies interested, Southeastern Kansas will have 2,000 oil wells in less than six months."

The meeting of the Kansas State Board of Agriculture was largely attended and was, as usual, an event of great importance, the addresses, the papers read, and the reports of officers indicating the substantial advancement of the State. gation is going forward with a rush. Extracts from some of the papers and reports are given elsewhere in this number. officers elected were: President, J. M. Potter, Peabody. Vice-president, A. C. Shinn, Ottawa. Secretary, F. D. Coburn, Treasurer, Samuel T. Howe, Topeka. New members, Joshua Wheeler, succeeds himself; A. W. Smith, succeeds himself; J. H. Churchill of Dodge City; I. L. Diesem, succeeds himself; George W. Crane, of Sheridan succeeds A. C. Shinn.

PRODUCTION OF GARDEN SEEDS.

A. G. Tillinghast, of La Conner, Wash., the pioneer seed grower of Puget Sound, shipped 800 bushels of cabbage seed to Eastern seedsmen in September.

In the Big Bend country of Central Washington, says the Spokane Review, an industry has been quietly springing up that is entitled to a great deal more attention than it has been given. It is the growing of all kinds of garden seeds, under contract with some of the biggest seed houses in the world, these houses having found the soil and climate there the best in America for that purpose.

AN AGRICULTURAL REVOLUTION.

Several years of cultivation of Kaffir corn in Kansas have demonstrated that it is one of the most remunerative crops that can be grown under conditions existing in that State. That the farmers realize this fact is proven by the remarkable increase in the acreage shown by the reports of Secretary Coburn of the State Board of Agriculture for 1895. In 1893 the total Kaffir corn acreage was 46,911; in 1894, 95.237; and in 1895, 184,198.

There will be an agricultural revolution in Kansas this year. It will not only affect Kansas, but will spread all over the western half of Nebraska and Oklahoma. King Kaffir will contest every inch of an area equal to 105,000 square miles with King Corn, and the best judges of conditions prophesy that Kaffir will win.

MAKING ORANGE WINE.

At Riverside, Cal., a great building is now being erected for the purpose of working up the culled oranges into wine. There is always, even under the most favorable circumstances, a percentage of culls for which there has been no market at any price. The oranges are good, but, from some external defect, are not marketable. These oranges can be had at a very low price, of course, and any way of working them into marketable products, is, of course, so much clear gain. Redlands, Cal., will also have an orange winery.

NATIONAL IRRIGATION LEGISLATION.

The Secretary of the Interior recently sent to the Senate the report of the Board of Irrigation Executive Department. It was referred to the Committee on Irrigation and Reclamation of Arid Lands, and ordered printed, and copies of the pamphlet can now be had. The report is of the greatest importance to irrigation interests. It shows the progress of the Board of Irrigation, including a statement of its organization; the existing legislation relative to irrigation; the operations of the various subdivisions; the principle which should govern subdivisions, and the list

of official publications on irrigation. This latter list was given in detail in the January number of The Irrigation Age.

It is evident that the importance of irrigation is appreciated at the national capital, and that the Board of Irrigation is doing excellent work. Hon. Francis E. Warren, of Wyoming, who has been made chairman of the Senate standing committee on the subject, is the very man for the place, and that he will push forward all the urgently needed new legislation may well be expected.

ANNULLING LAND GRANTS.

The President has sent a special message to Congress urging the necessity for immediate legislation to extend the limit of time within which suits can be brought by the government to annul grants of public lands. He called attention to the numerous complications that had arisen between railroads as to grants that overlapped and the necessity for adjustment. The time in which suits can be brought expires March 3, 1896, and if the time limit were allowed to expire then a portion of the adjustment act would be rendered nugatory. The government, the President says, in conclusion, should not be prevented from going into the courts and righting wrongs perpetrated by its agents.

THE COAST SALMON PACK.

The salmon pack, spring and fall season, for the entire Pacific coast, was 2,034,877. Of this amount Alaska furnished 637,000; British Columbia 512,877.

NEW MEXICO OFFERS HOMES TO THE ARMENIANS.

Amadeo Chaves, territorial superintendent of public instruction for New Mexico. has addressed a letter to Edward F. Cragin, chairman of the Chicago executive committee to aid the Armenians, thanking him for his suggestion of colonizing these people in New Mexico and offering to supply the necessary land free of cost. Mr. Chaves considers Mr. Cragin's idea the happiest solution of the Armenian problem. that has yet been advanced. He has looked into the character of the Armenians and regards them as a very desirable class of settlers. In Western Valencia county, along the line of the Atlantic & Pacific Railroad, Mr. Chaves has extended landed interests, and he proposes to place at the

disposal of the Chicago Armenian Association, free of cost, all the land they may desire to colonize, up to 500,000 acres. Or, if the committee deems best to locate the colonists on public lands, Mr. Chaves offers his services to enable the people to secure such locations.

A BUREAU OF LIVE STOCK INFORMATION

A memorial has just been presented to Congress which recites that the depression in the live stock industry of the West is due in a great measure to the indiscriminate way in which shipments are made to the four principal live stock markets-Chicago, St. Louis, Kansas City and Omaha. This memorial is signed by every Western exchange, and was forwarded by the executive committee of the National Exchange. It says there are no less than twenty-one States directly interested in shipping stock to one or more of the four markets mentioned, and that it is practically impossible for them to avoid glutting the market from time to time. The memorial asks Congress that some measures be provided whereby shippers can be informed (in an official and reliable way) of live stock receipts at these four centers from all of the twenty-one different States from day to day. If such a Bureau of Live Stock Information can be established, it will somewhat regulate the industry, and stock raisers and shippers will not be continually injuring their own interests and depressing the value of their own property.

WHY CATTLE RAISERS NEED PROTECTION.

Col. Albert Dean, agent of the Bureau of Animal Industry, has just received report of the number of cattle imported into the United States from Mexico for the month of November last. There were brought in from all points, 47,345. This is 1,645 more than the entire importation of the last half of 1893, as far as there is any record.

WASHINGTON IMMIGRATION ASSOCIATION.

The executive committee of the Washington State Immigration Association, just organized in the convention at Seattle, are: C. L. Webb, King county; A. S. Cole, Whatcom; E. G. Crawford, Clarke; E. J. White, Pierce; H. Bolster, Spokane; E. F. Benson, Yakima, and Harry Cornwall, Colfax. This committee organized by the election of C. L. Webb, president;

H. L. Bolster, Spokane, vice-president; and the president was authorized to appoint a secretary and treasurer. The committee earnestly recommended that an appropriation of not less than \$25,000 per annum should be made by the next Legislature for the promotion of immigration work.

THE WESTERN FRUIT INDUSTRY.

The Northwest Fruit Growers' Association includes Washington, Idaho, Oregon and British Columbia. The Bureau of Information recently organized has the folowing officers: President, W. S. Offner, Walla Walla; secretary, Willis Brown, Portland; directors, J. B. Holt, Wawawai; J. M. Gilbert, North Yakima; H. H. Spaulding, Almota; Emil Shanno, The Dalles. Headquarters are at Portland. Reports of the number of cars shipped to Eastern markets are to be received daily from all shipping points on the coast, including California, and then forwarded to local shipping points covered by the Association.

The Western Montana Fruit Growers' Association has been incorporated.

Colorado and New Mexico apples are breaking up the German apple monopoly in London. The Colorado and New Mexico product keeps better than the German. This year thousands of barrels will be shipped to England mainly by reason of a low rate lately obtained by growers, by which, in train load lots, apples can be exported from Denver to Liverpool at the same rate as from New York City.

The time is not far distant when England and quite a part of Western continental Europe will be supplied with fruit from the United States, and to quite an extent with fruit grown in the State of California and other Western States, where plums, nectarines, cherries, peaches, etc., are prouced of a character that will bear transporoation and delayed consumption with a not too serious deterioration in quality.

Stark Bros.' Orchard Bulletin remarks upon the great run given California fruit and vegetables in the Central, Western and Eastern States. It concludes an article with this: "Why not Ozark peaches and pears, adding Missouri or Arkansas, as the case may be, and why not Missouri, Illinois, Kentucky and Tennessee corn and tomatoes, as well as fruit? People of the Ozarks, Colorado and New Mexico are beginning

to wake up, and soon California will cease gathering all the cream."

A serious row regarding divisions on California freight traffic has just broken out between the Western Freight Association and the Southern Pacific Railway

Company.

The bad treatment Western Fruit Growers and shippers get in Chicago has been the subject of much discussion of late in the annual meetings and at the Exchanges, and reform in this respect is demanded. Uniform, fair rates of transportation are also demanded. Cut rates and rebates to certain shippers only injure the general trade.

DEFRAUDING THE SETTLERS

A special detective from the Wisconsin district has been investigating the offices in the State of Washington in the guise of a litigant and reports that a cabal exists, composed of many prominent men in Western Washington, some of whose names are given, who are engaged in a gigantic scheme to steal public lands and defraud settlers, and that Receiver Hawkins' connection with them, innocently or otherwise, calls for his removal. Register Murphy is believed to have had no connection with this scheme.

WESTERN MEASURES IN CONGRESS.

The House committee on public lands has decided to favorably report the bill introduced by Representative Wilson, of Idaho, to give 25 per cent of the proceeds of mineral lands in public land States for the support of schools of mines.

"A Free Home bill," making actual residence on railroad land grants unnecessary where lands had been fenced and improved, has passed the House.

On motion of Mr. Bowers, Republican, California, a bill has passed the House authorizing the Secretary of the Interior, under regulations to be fixed by him, to permit the use of right of way upon public lands for the purpose of generating electric power.

A NEW ENTERPRISE.

The Pawnee Pass Reservation Company has filed a request with the State Land Board of Colorado, to be sent to the Secretary of the Interior to segregate 300,000 acres of land in Logan county for reclamation under the arid land law. The company is represented by R. C. West, of Greeley. The proposition of the company is to construct a reservoir to hold 1,500,000,000 cubic feet of water, which will be sufficient to irrigate 300,000 acres of land. The ditch which will be constructed will be fifty miles long.

A CORRECTION.

Editor IRRIGATION AGE: In your biographical sketch of me in your issue of THE AGE for January, there is one error which I desire to correct, as it might work an injury to an engineer of high standing and of whom I have the highest opinion. It is the statement that I had exclusive charge of the Jurupa Canal and Vivienda Pipe Line in San Bernardino county, California. While these works were being designed and constructed I was associated in business with Walter C. Parmley, C. E., now of Peoria, Ill., and his share and responsibility in them were equal to my own. I make this statement in justice to Mr. Parmley, knowing that you did not publish it intending to slight him, and because I do not wish any more praise than justly belongs to me. Mr. Parmley was associated with me in the practice of irrigation engineering from 1887 to 1889 and I am proud of this fact and the fact that all work done by our firm was highly success-F. C. FINKLE. ful.

GOOD ROADS IN ILLINOIS.

At the ninth annual convention of the county supervisors and commissioners of Illinois, held at Kankakee, the convention was organized permanently under the name of the State Association of Supervisors, County Commissioners and County The chair was authorized to appoint a committee of nine to present recommendations of the convention to the next A. G. Woodbury, of General Assembly. Danville, spoke upon "Roads and Bridges." He said good gravel roads could be built for \$1,500 a mile, macadam from \$1,800 to The passage of the Bogardus \$7,500. road bill was recommended; also that the road and bridge law be amended so as to increase the amount that may be levied from 20 cents on \$100 valuation to 40 cents.

MINES AND MINING OUTPUT

Official estimates from the national capital do not correspond with the figures given out at the Western mining camps in regard to the production of the precious metals for the year just closed. It is announced from Washington that the Director of the Mint has received approximate estimates of the gold and silver product of the United States in 1895 from the mint officers and other agents employed to collect these statistics. The value of the gold and the number of fine ounces of silver produced by the several States and Territories is estimated to have been as follows:

		Silver ounces.	
Source.	Gold value.	fine.	
Alaska	. \$ 1,500,000		
Arizona	2,067,100	1,000,000	
California	15,600,000	154,700	
Colorado	. 15,000,000	22,000,000	
Idaho	2,790,700	4,000,000	
Michigan	40,000	35,000	
Montana	4,392,700	14,500,000	
Nevada	1,700,000	622,600	
New Mexico	1,075,000	154,700	
Oregon	2,200,000	7,700	
So. Appalachian State	s. 316,200	1,200	
South Dakota	4,255,000	82.200	
Texas		206,000	
Utah	. 1,352,300	8,223,800	
Washington	300,000	11,600	
All others	25,000	500	
Total for 1895	.\$52,614,000	51,000,000	
In 1894		49,500,000	
Increase	\$13,114,000	1,500,000	

VISITORS were present on the opening day of the Chicago Mineral and Mining Board from all over the West, Colorado being especially well represented. The committees are going slow, and trying to be safe and sure, and thus far but fifteen stocks are listed, though many more are clamoring to be listed. Those already admitted are mostly Cripple Creek properties which produce and pay dividends. In his opening address President John Marder said: "The management desires to have it distinctly understood that the board is not limited to affording facilities for dealing in properties, stocks, bonds, and securities connected with the precious metals only,

but that especial facilities will be afforded for the presentation of coal, iron, copper, zinc, phosphates, and all other mineral properties, by bringing into immediate contact and intimate relations those who have mineral properties to sell or develop with those who have capital to make them productive."

Tunnel-mining is being resorted to more than ever in the Cripple Creek region. The laws of Colorado allow tunneling under other men's property. Tunnels are now being run under Gold Hill mountain, on which are a number of the great producing mines.

A WELL-INFORMED WRITER states that the best known plan and safest for the investment of outside capital in mining is the formation of a close corporation for the actual purchase, development and operation of mining property.

STOCKS listed on the Chicago Mineral and Mining Board thus far are Isabella, Anaconda, Pharmacist, Portland, Union Gold, Favorite, Sleepy Hollow, Jefferson, Justice, Squaw Mountain, Finance and Rhyolite Gold.

THE values of the Colorado products for 1895 are claimed to be as follows: Gold, \$18,605,000; silver, \$14,259,049; copper, \$877,492; lead, \$2,955,114; coal, \$6,665,-136; iron, \$1,586,200; steel rails, \$1,348,-500.

JOHN MACKIN and John J. Philbin, Jr., of Chicago, have bought gold lands near Prescott, Ariz., within fifty miles of the locality selected by N. K. Fairbank, Marshall Field, and Lyman Gage.

Representatives of all the mining exchanges of the West are attending the opening of the New York Exchange. A big excursion train was run from Denver.

The Mechem Investment Company have opened a mining exchange in the Western Union Building, Chicago, confining the lists wholly to Colorado properties.

MINING PIONEERS AIR THEIR VIEWS.

REUNION OF CALIFORNIA VETERANS IN CHICAGO.

MOST enjoyable occasion was the recent seventh annual business meeting and banquet, in Chicago, of the Western Association of California Pioneers. organization was effected in 1890 through the efforts of Charles P. Jackson, Addison Ballard, H. A. Eastman and others, and there are now 143 members. Chicago is rapidly becoming a great mining center, and, with the influx of mining men, it is likely that the membership will be largely increased. The reunion was held in the club-rooms of the Sherman house. At the business meeting the following officers were elected: President, Addison Ballard; first vice-president, Candam Knight; second vice-president, G. G. Curtis; treasurer, G. G. Pope; secretary, G. W. Hotchkiss; trustees, Joseph Clark, Israel Sunderland, Thomas Mahew, John Kinsey, J. A. B. Walker.

Among the members present were M. Parkins, George G. Custer, E. G. Crane, J. A. B. Waldo, W. E. Reed, S. P. Blodgett, L. M. McEwen, T. P. Sears, John B. Kerr, Addison Ballard, H. W. Emery, J. H. Smiley, G. W. Hotehkiss, J. C. Gault, John Kinsey, G. E. Strong, H. Latham, Thomas Mahew, J. A. Macomber, J. F. Thompson, William Johnson and others. Benjamin R. Nickerson, of Chicago, eighty-five years of age, is the oldest member. He is the only surviving member of the first California Legislature.

The decorations about the banquet room were of golden hue, as also those on the tables, and old-gold badges were worn by the veteran miners. A more hardy, better preserved, better informed or more jolly set of men has not come together in Chicago for many a day. All are wealthy, and most of the gentlemen are still in active business. As seen by the names, several are still prominent in politics, as well as business, in Chicago.

This annual reunion is held in commemoration of the discovery of gold in California, which occured January 24, 1848. September 9 is also a day of celebration, as it marks the admission of California into the Union in 1850.

Alderman Ballard was toast-master, and he used a handsome gavel made from the

wood of the hanging tree at Hangtown and Sutter's Mill, near which the first find of the yellow metal was made. There were no regular toasts, the time being occupied in discussing the good things on the menu, and in exchanging reminiscences and making speeches on the days of '49, when the California gold fever was at its height, as well as the days of Pike's Peak, and the new finds of today. "What was missed at Pike's Peak," in Colorado, by the armies of men who toiled about there in 1859, was dwelt upon by members who were there at that time. The Cripple Creek of today is down the southwest slope of Pike's Peak, near its western base. 1859 men froze to death and died of starvation right in the neighborhood of where the new Cripple Creek diggings today.

George Custer made the Western trip in 1850. He told graphic stories of the hanging tree at Hangtown. After being in California for some time he returned to "the States," with his father by way of the Isthmus of Panama and New York. It was in 1849 that Mr. Ballard went to the California gold fields, and the trip consumed six months. Chicago then had no railroads. He returned in 1852. Mr. H. A. Eastman went by way of the Isthmus and remained ten years. Mr. Parkins (of Mendota, Ill..) went West in 1849, using a team of oxen, and the trip out was made in five months. In his party there was a long train of "prairie schooners." Mr. E. G. Crane, a cousin of Congressman Hopkins of Aurora, walked all the way to Pike's Peak in 1859.

After the reminiscences came discussions on the great progress of the West, what irrigation was doing for its development, the admission of Utah, and the bills in the present Congress for the admission of Arizona, New Mexico and Oklahoma. That ex-President Harrison had just made argument in the United States Supreme Court in favor of the California (the Wright) Irrigation District Law was regarded as conclusive that one great constitutional lawyer was willing to risk his reputation at a most critical time that the said law was constitutional.

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THE EDITOR'S DRAWER

A Chicago combination will reclaim 10,000 acres of land in Idaho.

BLOOMING UTAH, the forty-fifth star, is welcome as the flowers in June.

Colorado has a great opportunity just now to market her agricultural lands.

CHICAGO is becoming the mining center of the whole North and West—iron as well as the precious metals.

CONNECTICUT leads New England in resorting to irrigation and all the other States are falling into line.

This Congress will possibly submit its differences on tariff and silver to arbitration—arbitration at the polls.

The great salt springs and salt beds of Wyoming are abandoned because of the cheap imported Liverpool salt.

ONE sure way of securing new settlers is to secure new railroads and railroad extensions, and through connections.

Secretary Morton opposes the use of public money in solving irrigation problems in the West. But that gentleman will not be in office forever.

The great growth of manufactures in the far Western and Southwestern States within a year past is astonishing. Notwithstanding the tariff insanity, even woolen mills are among the industries.

ALL through the central Western States and the East and South, and also in Canada, the agricultural press has taken up the subject of irrigation, a fact that is most flattering to The Irrigation Age.

Which State or Territory wants the printers' colony? The many printers (or ex-printers) conferred with seem to prefer New Mexico. They will make good citizens and, with their intelligence, must become scientific farmers.

Washington and South Dakota have already followed out the plan of the Northwestern Immigration Bureau and organ-

ized State bureaus, with branches in each county, and the other States in the north-western organization will do likewise.

It is now suggested that Wyoming, Colorado, New Mexico, Utah, and Arizona, organize a great immigration bureau after the style of the one organized at St. Paul.

The Illinois Farmers' Institute urges the farmers of the State to make a special effort to secure the election of such members of the Legislature as will make laws to equalize taxes on farm property with those on other property.

H. V. HINCKLEY, Mem. Am. Soc. C. E., has been appointed by the commissioners of Shawnee county, Kansas, to have charge of the Melan bridge to be built in the City of Topeka. It will be the largest Melan bridge on the American Continent.

Hon. F. D. Coburn was re-elected secretary of the Kansas State Board of Agriculture by a rising vote, a compliment well deserved. The farmers of the State, and people in all occupations, well know and duly appreciate Mr. Coburn's great services.

It is a question whether the Standard Oil Company has gobbled up the Kansas oil fields or vice versa. Anyway, operations have begun and it is predicted that the exciting scenes of Oil City, Pa., and thereabouts are to be repeated in Southeastern Kansas.

THE fact of the possibility of such an association of associations—such a federation of interests—as the National Association of Manufacturers of the United States is in itself one of the signs of the times. Congress will never be allowed in the future to disturb and injure the business of the whole country.

As EXECUTIVE committee of the South Dakota State Immigration Board, the following gentlemen were elected: F. W. Morris of Tripp; T. H. Brown, of Sioux Falls; S. N. Narregang, of Aberdeen; J.

M. Greene, of Chamberlain; A. J. Lockhart, of Clear Lake; J. H. Baldwin. F. W. Morris was elected president, S. W. Narregang secretary, T. H. Brown treasurer.

Prairie farmers in the central Western States are all preparing to have irrigation reservoirs, and for more reasons than one. They want food fish, and they also want a supply of pure ice for the hot months of summer.

The fruit growers of California, New Mexico, Colorado, Washington, Idado, and Oregon, have thoroughly organized and they ask justice from the railroads and from the Chicago commission men. They have not been fairly treated by some of the Chicago dealers.

NEW mining legislation will likely come from Washington which will greatly simplify matters. An attempt will be made to pass a law requiring that there shall be no workings beyond the width and length of each claim, doing away with the present method of following leads.

To an interested observer it would seem very much as if those exhibition trains through the central West and East did just the opposite to what was desired. Instead of prompting farmers to change their locations, the splendid crops exhibited suggested to them that they could remain at home and irrigate their present holdings.

Congress must throw safeguards about those 1,000,000 acre land grants to the Western States and Territories. The cattle interests should be considered, of course, but it is openly charged that Chicago and Eastern so-called cattle kings are laying plans to gobble up these lands under long leases from the States and Territories.

The fifteenth annual meeting of the American Forestry association was held at Washington recently. The main object of the gathering was to secure the enactment of a law for the proper administration of the forest reserves in the United States, which aggregate 17,564,800 acres, and to secure the protection of the forests on public ands.

A "POPULAR LOAN" is somewhat better than a deal in which a syndicate gathers in millions, but the necessity for a "popular loan" and the loan itself are to be deplored. Of course numerous banks will suspend payment rather than let the people withdraw their deposits to invtes them in bonds. Money in the banks is really money in circulation in business enterprises.

BI-METALLISM seems still to be going to the front. In his speech at Columbus, Mr. Foraker, the new Republican Ohio senator, outlined his policy as favoring protection to home industry and also bimetallism. He believed the world made a mistake when it demonetized silver, and "sincerely hopes that some safe way may be found for the restoration of silver to its rightful place alongside of gold as a money of ultimate redemption."

At the annual meeting of the Western Society of Engineers, in Chicago, officers were elected as follows: President, John F. Wallace, chief engineer of the Illinois Central; first vice-president, Thomas T. Johnson of the drainage board; second vice-president, Alfred Noble of the Nicaragua Canal board; secretary, Charles J. Roney treasurer, E. Gerber of Morrison & Gerber, engineers; trustee, Horace E. Horton, president of the Chicago Bridge Company.

Ir Western and Northwestern farmers see fit to risk themselves and their families south of Mason and Dixon's line, well and good. It may be truthfully stated, however, that the survivors of colonies which went South from the Northwest two and three years ago, and who have just managed to get back, tell most dismal tales. They insist that only negroes can work in that climate. They say also that in many cases it was impossible to perfect the titles to land.

The comparative small cost of irrigation in Illinois and the other central Western States, as shown in the January number of The Irrigation Age, seems to have astonished the farmers. Further information on the subject is given in this number. The irrigation fever is an epidemic that is sweeping in every direction, especially in this State, Indiana, Michigan, and Wisconsin. Experiments are also being made in Missouri.

TOPICS OF THE TIME

Defrauding The one most important matter to be considered in Settler. purchasing Western lands is the water supply for irrigation: On the correct answer to this depend the welfare and prosperity of the settler. Climate, fertility of soil, transportation facilities and nearness to markets are of no avail if the water supply is inadequate. practice, so common among a number of land and irrigation companies, of selling water rights when they cannot deliver the water, is outrageous and it is working injury to every Western interest. The prospective settler looks with distrust upon every proposition because he has heard of some one who has been deluded and swindled by purchasing land and water upon promises made but to be broken and by having conditions falsely represented. water supply in the streams has in many cases been over-appropriated and the settlers who have purchased and paid for the water in good faith suffer for the sins of others and are a prey to the extortion and greed of the reckless money grasping company. This condition of affairs is a positive detriment to the entire West and especially to those individuals and companies who are doing a legitimate business and dealing fairly with their patrons. THE IRRIGATION Age proposes to take a stand on this question hereafter and it will work for the best interests of the honest land company and the prospective purchaser.

The There is a general desire West is that a national commission be Waiting. created to regulate the distribution of irrigation waters in the West, and in the country generally, for it is evident now that the sure mode of farming is to obtain on an extensive scale, in all sections of the country. Something looked for a long time ago was a decision by the United States Supreme Court of the question before it as to the constitutionality of the Wright District law in California, but it is not yet forthcoming. The district laws in other States being

about the same, this decision will have equal application. While this legislation and court business is pending there is of course uncertainty, and the rapid progress of development in Western America is much retarded. The people of the country are growing very tired of the political pulling and hauling at the national capital and would like to see Congress get down to business.

How innocent of The commissioners authorized by Discovery. Congress to choose a deep waterway connecting the lakes with the Atlantic ocean! Interviewed at Detroit, they "have not the least idea, as yet, what route may be chosen." Well, here's a guess: Chicago is spending about \$30,-000,000 building a "Drainage Canal." When this is completed there will be only a short strip between the end and the Mississippi river. In other words, here is a deep waterway already about built. What more natural than that the commissioners may "discover" this canal and recommend that the government complete the waterway to the Mississippi, thus connecting the lakes and the Atlantic ocean? Why, gentlemen, whether you know it now or not, that was the sole purpose of the creation of your commission. Come to it, you must. The South and West will push this through Congress in spite of all Eastern opposition.

America Free wool has brought the Pacific coast sheep raisand the practically free importations of Mexican cattle would eventually put the cattle industry in the same ship. But all that will be regulated by and by.

It is asserted and reiterated for the farmers (not by the farmers) that a protective tariff does not benefit them in the least—is rather against their interest. It was promised that the Wilson free trade law would enlarge the markets of American producers, thus benefiting them, but

as a matter of fact it has injured the farmer, and the manufacturer as well. Here are some official figures: During the first nine months of the Wilson law in 1895, the imports of agricultural products, including live stock, breadstuffs, eggs, flax, feathers, fruits, hay, hides, hops, provisions, rice, seeds, tobacco, vegetables and wool amounted to \$85,256,219 against an importation of the same products of \$55,840,848 during a like period of the last year of the McKinley tariff, showing a direct loss to American farmers of \$29,415,371. On the other hand, the exports of the chief agricultural products showed a decline of \$23,787,180.

Irrigation At the close of a calendar year the agricultural, commercial and industrial progress of a section can be figured up. The live and aggressive press of Western America has done its figuring for 1895, and the results are astonishing. Irrigation has done wonders, these wonders have attracted attention to the West generally and to the hidden wealth of the earth in particular. Investors have been attracted to the mining properties, and they are to be worked during 1896 as never before. There will be armies of immigrants in the spring, and the development of the mining and agricultural resources will go forward with a rush. Now is the time for the various States and Territories to let this country and Europe know fully the merits of their agricultural lands. The Northwest Immigration convention at St. Paul, and the Washington and South Dakota State Immigration convention were most timely, and cannot fail of good results. Each State and Territory, however, should have an immigration bureau East, with branches at the seaports and also in the great central cities.

Advance. The first, last and best indication of a country's prosperity and advancement is the appearance of its newspapers. On Christmas and on New Year's Day all the Western and Pacific coast papers issued specially prepared numbers, which were models of excellence and beauty; but it is the common every-day issues that are alluded to here. They are full of local news, have copious telegraph dispatches from all

quarters in this country and abroad, are ably edited and, in typographical appearance, are the peers of the press anywhere in Christendom. Western America also has its own magazines, illustrated to perfection. There is no longer any "rowdyism" in Western literature. Rare good taste is displayed by the editorial management, and the manners of this literature are the most metropolitan.

The immense corn crop Most and the consequent low Experience. value, and the hog cholera with its great losses, will doubtless force upon the minds of central Western farmers the urgent necessity of diversifying their operations. One or two specialties cannot be depended upon. With, at least, a small patch of orchard and garden irrigated (to be dead sure on), and a diversification of operations generally, giving some attention to dairy and poultry, no farmer can be wholly stranded, as thousands have been the past season. Many men who have heretofore paid their whole attention to stock raising will do something in agriculture on the side during the coming season. If the affairs of the State granges were systematized and reports required from each member, it would seem within the range of possibilities for each farmer to be notified before planting time of the total average contemplated for at least corn and wheat. The extension of the corn belt and the advent of cotton seed must be taken into all calculations. It seems likely that Mr. P. D. Armour will rake in millions of dollars through the mistakes and disasters of 1895.

Investigating Notwithstanding the recent "iron-clad" ruling by Department. the Department of Agriculture that packers could no longer use any name for their oleomargarine that is "suggestive of the dairy," it is alleged that a permit has been obtained from the department by the Kansas City Armours which will allow them to continue to stamp and label their bogus stuff "Silver Churn." The dairy interests are asking' what such conduct on the part of Secretary Morton means, and urge that, with this permit the recent ruling cannot be consistently enforced against other packers who stamp a milch cow or a churn on their bull butter.

FISH AND ICE ON IRRIGATED FARMS.

PUMPS AND RESERVOIRS EVERYWHERE.

IT is not at all surprising that farmers in the central Western States are all determining to irrigate strips of orchard and garden patches, even if they can do no more immediately. They want the reservoir because it not only makes the crops irrigated certain and four to six fold greater, but it furnishes fish, and during the winter, a supply of pure ice can be cut that will last all the next summer. The solution of the ice problem alone on prairie farms is a great feature.

That the reservoir is within the reach of all is indicated beyond a doubt by the figures of M. B. Tomblin, of Kansas, on windmill irrigation on the plains. He says: "My windmill plant consists of a five-inch tubular well, operated by a sixteen-foot steel back-geared wheel, built expressly for this kind of work. The reservoir into which the pump discharges is eighty-two feet in diameter at the base, inside measurement. The walls are six feet high on the outside. The bottom, as well as a strip about eight feet wide under the walls, was thoroughly puddled, and the reservoir seems to hold water perfectly. In a good wind the pump discharges about twenty gallons a minute. Everything connected with the pump and windmill is of the most solid and substantial character. A much lighter and cheaper plant could have been purchased, and would probably have done the same work, for a time at least, but the fact that the mill is turned loose to the wind at all times, stormy as well as fair weather, and has cost me less than one dollar for repairs during a year, and today is apparently as good as ever, convinced me that I made no mistake in choosing the very strongest and best material throughout. The plant cost a little less than \$500.

"When a farmer can do a great share of the work himself, such as building the reservoir, helping the wall men, etc., the cost can probably be reduced \$100. The tract selected for my experiment was a seven-acre orchard of young trees, and a three-acre plat adjoining." After reciting the great success of his crops of vegetables, the writer adds: "My reservoir was stocked with fish and now affords me a much better article than the market supplies; another year I can take from it a thousand pounds of fish and still leave it as well stocked for the following year. The reservoir will afford me 100 tons of ice this winter, furnishing an abundance for my own use, and some to sell to my neighbors."

Official figures are also at hand from Hon. J. H. Baldwin, State Irrigation Engineer of South Dakota, which will prove of importance to new beginners in Illinois and other central Western and Eastern States: He says: "Here in South Dakota we have two distinct classes of artesian wells, one of which is deep and the other termed shallow wells, and many people not acquainted with the condition are often mislead as to the value and These shallow wells are being difference. put down in great numbers and are not expensive, yet they are very valuable both for stock and general domestic uses and for irrigating small tracts of land. The cost of these shallow wells runs from \$100 to \$300 as a rule, yet some cost even less. The depth varies from fifty to 300 feet. There are over 300 of this class. Of deep wells, there are about 150 in active operation. The depth varies from 500 to 1,500 feet and they cost, with everything complete, about \$300 per foot. A first-class well will furnish 600 to 800 gallons per minute. The water properly served up and handled will supply 2,000 acres. The number of new wells that will come in use next spring and summer depends on the ability of townships to negotiate their bonds."

No act of the Kansas Legislature of 1895 received more commendation in the State Board of Agriculture at its recent session than the one providing for the State Board of Irrigation and the appropriation of funds to carry on experiments.

In D. M. Frost, of Garden City; W. B. Sutton, of Russell, and M. B. Tomblin of Goodland, Governor Morrill selected excellent timber for that Board, and the review of its work, thus far, by Secretary Sutton, speaks volumes. President Potter and Secretary Coburn of the State Board of Agriculture were both re-elected.

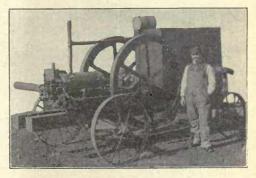


T. W. GRAHAM.

A WESTERN MANUFACTURER.

W. GRAHAM, President of the Dubuque Turbine & R. M. Co., was born at Rutland, Vermont, February 21, 1848; moved to Iowa with parents in the spring of 1854. They settled in Clayton county, Iowa, and engaged in farming and saw-milling. He was educated at the country school; got the Western fever in 1871; went to the Kansas frontier; preempted a quarter section of land and made some improvements thereon. The experience of the few years following with grasshoppers and fever and ague persuaded him to return to Iowa. In 1875 he went to work in a mill owned by an uncle at Rockford, Iowa; learned to dress burrs and grind. He also worked some at mill-wright work, building flour bolts and elevators under his uncle's directions. He worked at carpenter work and millwrighting until 1881, when he bought a one-half interest in the Flenniken water wheel. Went to Dubuque and made

arrangements to have the wheel manufactured there and at Rockford, Ill. Sold wheels and mill machinery until 1886 in partnership with R. B. Flenniken of Colesburg, Iowa. In that year Mr. Flenniken retired and later on Mr. Frank Williams, of Moline, Ill., took his place in the partnership. Commenced the manufacture of flouring mill machinery about that time on a small scale in rented rooms in Iowa Iron Works and later on in Novelty Iron Works. In 1891 the business had outgrown the limited facilities for manufacturing and a stock company was organized and the present shops of the company were erected.



A WITTE PORTABLE GASOLINE ENGINE.

GASOLINE ENGINES.

The above is a cut of a twenty-five horse power portable gasoline engine, recently shipped to Southern California by the Witte Iron Works Company, of Kansas City, manufacturers of the Witte gas and gasoline engines. In that country where water is scarce gasoline engines are the popular power and the county to which this one is shipped alone has 1,600 in use. The many advantages the portable gasoline engine possesses are readily perceived. No water to haul, fuel for a week's run easily carried, and no danger from flying sparks. For irrigating, the pump is placed on the trucks with engine, thus making a compact outfit very easily handled. Every farm and ranch of any size should have some such power for grinding feed, pumping water for stock, and especially in the West for irrigating. The Witte Iron Works Company make these portable engines in sizes from one and one-half to fifty horse power, and, while they make them for sale, would be pleased to correspond with parties who, if unable to purchase an entire plant,

would like to have their farms irrigated for so much per acre. For full information write them, and mention THE AGE.

AN IRRIGATION EDITION.

"Every Farmer or Gardener interested in Irrigation should send 5 cents in postage stamps to The Dakota Farmer, Aberdeen, South Dak., and get a copy of that paper dated November 1, and which was devoted entirely to Irrigation and the Greatest Artesian Basin in the World. It is profusely illustrated and is one of the best special issues which we have seen this year."



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The new 160-page finely illustrated Poultry Guide, Poultry Doctor and Combined Incubator and Poultry Catalogue of the Reliable Incubator and Brooder Company, Quincy, Ill., for 1896, is a superb publication. It is a book which should be in the hands of every wide-awake up-to-date progressive poultry raiser. This Guide tells a great deal about the profits on poultry; about feeding, especially for eggs; about Pekin Duck farming; about the characteristics of twenty-five leading varieties of fowls, ducks, geese and turkeys; about killing, dressing and shipping market poultry; about the common diseases of poultry; about hatching eggs with machines; about brooding chicks without hens; about building incubator cellars, brooding houses, etc.

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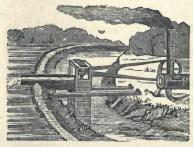
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WHEN THE CLOUDS ARE IN THE BLUE.

You may say that life is trouble When the clouds are in the blue; But a fellow finds it double When the

> Note Falls

Due!

Sorrow's nothing but a bubble That will vanish from the view; But it's trouble, trouble, trouble, When the

Note

Falls Due! .

And the corn—it goes to stubble, And the rose-it withers too; And it's trouble, trouble, trouble,

When the Note

Falls Due!

Go it single file, or double, There'll be work enough for you In a living world of trouble, When the

Note

Falls

Due!

-F. L. Stanton in Atlanta Constitution.

AGRICULTURE EAST AND WEST.

In the East the question of fertilizers is all-important, and the farmer who is not up to date on all questions concerning them is at a disadvantage in the competition.

In the great plains region of the West, the elements of fertility are superabundant in the soil, the small rainfall having produced insufficient run-off to carry them

Here, therefore, the question of conserving moisture by cultivation and of adding to it by irrigation are all-important. distinctive agriculture of the plains region Arm

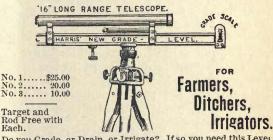
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LAND GRADERS.

We have received from Mr. B. F. Shuart, of Oberlin, Ohio, a newly issued circular descriptive of the improvements which, in response to the demands of patrons, have recently been made in his Steel-Improved Land Grader, advertised in this magazine. Originally designed to meet the needs of irrigators, simply, this machine has proved itself adapted to a much wider range of possibilities, and is being sought after by road-builders and contractors in earth as the most satisfactory and efficient appliance available for a great variety of purposes involving accurate grading. The machine is now made in three different styles. The testimonials are from widely scattered sources and accord to the grader a high degree of

Mr. Shuart also sends us a copy of his article on how to start alfalfa, which appeared in The Age for September, 1894. Thousands of copies of this circular have been gratuitously distributed, and Mr. Shuart writes that he has received numerous letters from alfalfa growers in California, Nebraska and other States thanking him for having put them into the way of complete success after repeated experiences of failure. We advise our readers, who may be interested, to write to Mr. Shuart for these circulars.

Feeling the need of medicine the other day, Pat applied to a doctor with whom he was acquainted. Medicus asked the symptoms, felt the pulse, examined the tongue and did whatever else professional etiquette demanded. Then he said:

"Patrick, you're run down a bit, that's all. What you need is animal food."

And Pat departed quite contented. About two days afterward the doctor happened to think of his case, and called on Pat in the stable.

"Well, Pat," said he, "how are you

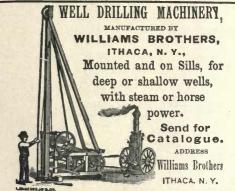
getting on with the treatment?"

"O, shure, sir," said Pat, "Oi manage all right with the grain and oats, but it's dommed har-rd with the chopped hay."

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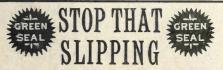
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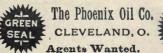
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THE IRRIGATION AGE.

VOL. IX.

CHICAGO, MARCH, 1896.

No. 3.

WATER SUPPLIES FOR IRRIGATION.

III. MEASUREMENT OF STREAMS, GAUGING THE UNDER-FLOW.

By F. C. FINKLE.

RAINFALL is variable in all countries.
At times a storm occurs when as much water falls in the space of a few hours as during all the balance of the year. Again, certain seasons are subject to frequent and heavy storms, while others are wholly, or almost so, devoid of rainfall. This marked division of the year into a dry and a wet or rainy season is particularly the case in countries where irrigation is necessary, and as has been already shown, is one of the principal causes which make irrigation a necessity in such districts. The natural streams, being fed by the fall of rain on the watersheds tributary thereto, will vary in their discharge as the season is dry or wet. During the wet season, when rains are heavy and frequent, the streams will rise and flow large quantities of water, which cannot be diverted and used for irrigation, as the water is not needed at that time of the year, the ground being already saturated by the natural rainfall. The only manner in which this storm flow can be utilized is by storing it in reservoirs, and thus conserving it until the dry season; this subject will be subsequently treated under the head of storage reservoirs.

At present our discussion will be on the value of natural streams for irrigation purposes during the irrigation season, when the flows of streams are at their minimum.

Before an enterprise is founded with the natural flow of a stream as a water supply, it is necessary to make a careful determination of the minimum discharge of the stream during the season of irrigation. As soon as the extent and character of the watershed which feeds the stream is known, we are able to judge approximately of its value as a source of water supply. A flowing stream derives its supply of water during the season of no rains either from melting snows or from springs. Both of these are the accumulations from the season of rains, and to what extent depends on the area, elevation and nature of the watershed.

If the watershed is large and high it will contain a plentiful quantity of snow at the end of the rainy season, which by reason of the coolness of the atmosphere at a high elevation, will have fallen, and will gradually melt during the dry and warm season following, thus feeding the stream flowing from it.

Again, if the watershed is composed of loose and impervious layers, intermingled in such a way as to create underground basins and channels, which accumulate the water and again conduct it to the surface later in the season, the stream to which it is tributary will be fed by springs. In these two ways, viz., by melting snow and springs, the streams are supplied with water during the dry season, and understanding these principles we are able to judge somewhat of the capacity of a stream for supplying water for irrigation, as soon as we have become acquainted with the characteristics of its watershed. But it is

impossible to know the exact ability of a stream for supplying water unless it has been gauged or measured for a number of years during the season of minimum flow.

METHODS OF MEASURING.

There are a number of methods in use for determining the flow of a stream of water confined in a fairly well-defined channel of its own. Sometimes the result is attained by determining the mean velocity of the flow and measuring the area of cross-section occupied by the flowing water, while at other times it may be more convenient to erect a measuring weir, and by the use of a weir formula determine the rate of flow.

If the former of these methods is used, the velocity may be determined by a current meter, or the slope and cross-section may be measured and some suitable formula for the flow of water in open channels employed for calculating the result.

Circumstances must govern an engineer almost wholly as to which method he should employ. In the case of a stream, which is neither too large nor too rapid to prevent the construction of a measuring weir across it at a reasonable expense, this is the best method to adopt, as the result obtained is invariably more accurate than by any other method. On the other hand, when a stream is either too large or swift, or cannot be easily controlled over a weir for some other reason, it is better to determine the velocity of the water and the area of cross-section it occupies, and let the result depend on these determinations, rather than to attempt the more expensive expedient of constructing a measuring

The details and formulæ for measuring the flow of streams will be fully discussed in succeeding chapters devoted to the flow of water in open channels and over measuring weirs.

UNDERFLOW OF STREAMS.

All the water supply of a river or creek is not always visible on the surface of the ground constituting the bed of the stream. Sometimes a large proportion of the water flows under the surface of the ground entirely and is not visible, giving no ocular evidence of the existence of more than that which flows in the channel of the stream. Again, the entire flow of a stream may exist under the surface of the bed and no water be visible at all, except during pe-

riods of storms and freshets. Such streams are usually called "dry creeks," the fact that no water is in sight being taken as conclusive evidence that the water-courses in question possess no permanent and

regular water supply.

But in regions where water is scarce, either for domestic or irrigation purposes, explorations have been made below the surface, which have demonstrated that an underflow exists under the channels of most streams whether there is any surface flow or not. Such underflows have not only been often discovered, but in many cases have been fully developed and are now being used as a permanent source of water supply for domestic and irrigation

water systems.

The character and extent of the underflow of streams is in a great measure controlled by the same conditions which govern the surface flow, and must be investigated and analyzed in much the same manner. The same information in regard to rainfall, watershed, etc., which has already been discussed in the preceding articles in connection with the surface flow of streams, must also be collected and used in investigating the underflow of a stream as a source of water supply for irrigation. In addition there are many other subjects to be considered which will be discussed in the succeeding articles.

DEFINITION OF UNDERFLOW.

The underflow of a stream is water derived from rainfall descending upon the watershed tributary to the stream, which sinks into the ground until intercepted by the first impervious layer encountered and then percolates through the coarse material composing the bed of the stream in practically the same direction as the surface drainage. The above definition covers all the points which distinguish an underflow and enables us to identify it as such.

It is clearly distinguished from artesian water, which also originates from rainfall entering the ground before it reaches the channel of a stream, but is confined between two or more impervious formations, and is usually found at a considerable distance from the point where it first sinks, in the fact of its existence on top of the first impervious stratum encountered after penetrating the loose material of the channel, and in being devoid of pressure

sufficient to force it to the surface when the ground is penetrated by borings. It also differs from subsoil or surface water, which sinks from the rainfall and fills the voids in the subsoil, in the fact of its possessing motion or velocity caused by the slope of the water-bearing stratum and the pressure of water on a higher plane gravitating downward and tending to displace the particles of water on a lower plane.

EXISTENCE OF UNDERFLOWS.

There are many streams which do not possess any underflow of water, on account of the absence of such conditions as are necessary to produce one. The existence of an underflow is by no means an invariable accompaniment of a river or creek, but is possibly lacking in more cases than it is present. An underflow is also frequently found where there is nothing more than a dry wash to indicate the existence of a channel, which carries water only in times of extraordinary floods or cloudbursts.

The conditions required to produce an underflow in a stream are the following: (1) A suitable watershed; (2) a favorable surface topography; (3) sufficient and properly distributed precipitation; (4) proper character of channel and surface formation; (5) a hard substratum.

The above five heads cover all the conditions necessary to create an underflow of some importance in a stream, and by means of a thorough understanding of these it is possible to form an opinion on the existence of an underflow in any stream, after becoming acquainted with the natural characteristics of the stream and its drainage area. The discussion of the requirements above enumerated is a matter of importance, and while the articles on each topic will be brief, it will be the aim to cover the subjects so as to include all that is very essential.

SUITABLE WATERSHED.

A watershed must be of ample size to create the existence of any considerable underflow in the stream which drains it. But size is not the only or most important consideration, as a watershed of fifty square miles or even less has been known to furnish a goodly amount of underflow, where other conditions were favorable. On the other hand it often happens that a very

large watershed creates no underflow at all, on account of being lacking in other

A high watershed is very desirable, as the cool air at high elevations is a good condenser of the vapor in the atmosphere. and this serves to increase the rainfall. Besides, if the elevation is sufficiently high to cause a large portion of the precipitation to fall in the form of snow, this is a considerable advantage, as will be seen later on. Another advantage of a high watershed is that evaporation is at a minimum, and the loss from this cause much less than at lower elevations. It is safe to say, however, that the most important consideration in the character of a watershed, when its ability to produce an underflow is considered, is the nature of its soil formation. The surface must be loose and porous, allowing water to sink readily and penetrate it, while there must be a hard and impervious substratum at a reasonable depth, which is continuous, or practically so, from the summit of the watershed to the channel of the stream. If the surface soil is too hard and compact the rainfall will practically all flow off as surface flow into the channel of the stream, and very little, if any, will find its way into underground channels and produce an underflow.

Even if the surface of the watershed is as soft and porous as may be desired, if the substratum is not hard and continuous, but contains deep crevices and fissures leading to underground layers of softer material, or if the substratum is too deep and conducts the water down to other strata of loose material, the water which sinks will be conducted to considerable depths and distances, and instead of forming an underflow may reappear as springs or artesian water.

A FAVORABLE SURFACE TOPOGRAPHY.

The nature of the topography of the watershed or country contiguous to a stream has a remarkable effect upon the creation of an underflow in the stream. If the watershed pitches steeply downward and is very abrupt to the banks of the stream and its branches or tributaries, the water will flow off and into the channel very quickly without much of it entering the ground. After reaching the channel very little water sinks as a rule, except in

very exceptional cases, the channels of streams being usually covered with a coating of silt, which effectually prevents percolation to any appreciable extent.

On watersheds of diversified topography containing flats, wide canyons and broken and irregular ridges running in different directions, the opportunity for water to sink is good, and a large proportion of the water falling will enter the ground and become a part of the underflow, if the substratum below will sustain it down to and along under the channel of the stream.

Considerable importance attaches to the question of topography, and in studying a watershed respecting its ability to produce an underflow, an examination, as detailed as possible, should be made to ascertain the opportunities afforded for water to sink or run off.

SUFFICIENT AND PROPERLY DISTRIBUTED PRE-CIPITATION.

The fall of rain or snow on a basin or watershed must be sufficient and properly distributed throughout the year in order to create a good underflow from the drainage. If the showers are too sudden and violent, and partake more of the nature of a cloudburst of great discharge but short duration, the water will have but little opportunity for sinking into the ground. Too light rains are also undesirable as they either merely saturate the ground or the water is evaporated or transpired by the growing vegetation.

If the rains occur at intervals too far apart, the result is also unfavorable tounderflows, as the supply will be likely to become low or fail at times. The best rainfall for producing a large and unvarying underflow in a stream is that which occurs in moderate showers and without the intervention of too long intervals. If the year is divided into a wet and a dry season, the lack of moisture in the form of precipitation during the dry season may be compensated for by snow which has fallen during the wet season and gradually melts during the dry season, thus keeping up the supply.

Snow is the best form of moisture for keeping up a constant and unfailing supply of underflow under all circumstances. The melting of snow requires time and gives ample opportunity for the water to sink and reach the underflow.

PROPER CHARACTER OF CHANNEL AND SURFACE FORMATION.

In order to contain an underflow the channel of a stream must have a stratum of loose material through which the water can percolate after reaching the lowest dip in the bed rock or other impervious formation. If the bed of a stream is directly on the impervious formation extending throughout the watershed or basin, no underflow is possible, as the water sinking where this formation is covered by loose material, will again rise and become a part of the surface flow upon reaching the bed of the stream. It is not necessary, however, that the loose stratum should be continuous from the surface of the channel down to the bed rock or underlying impervious stratum. The underflow is often separated from the surface flow by one or more impervious strata; in fact, such a condition is more frequently met with than one where the loose formation is continuous.

Such impervious strata are deposited by the water and may consist of conglomerated or cemented gravel, compact clay, hardpan or other solid matter deposited by the water and firmly united by means of some component part causing adhesion. only condition required where such strata exist is that they do not touch the impervious formation underlying the whole watershed, but are separated from it by some loose stratum, through which underflow can move unimpeded. Cases where the two touch are very rare, owing to the fact that in all large drainage basins heavy floods have made deep loose deposits before the subsequent layers of the impervious material were deposited. cases where the loose stratum is continuous and not interrupted by intervening impervious strata the whole stream may sink and become underflow, unless the water carries silt sufficient to line the channel, or the flow of the stream has a sufficiently large volume and velocity to pass on even after filling all the voids in the material comprising its pervious bed. The surface formation of the watershed tributary to the stream must be loose and porous and be underlaid with an impervious stratum practically continuous to the channel of the stream in order to create any considerable amount of underflow.

A hard barren watershed, which does not

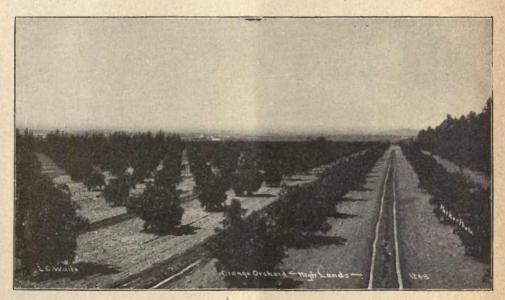
afford facilities for the water to sink, but which causes it either to flow off or be evaporated, is not capable of producing any considerable underflow, even when all other conditions favorable to an underflow are present.

A HARD SUBSTRATUM.

As has already been intimated, the existence of an impervious substratum is an essential to the production of an underflow. This applies both to the channel and watershed of the stream. The want of such a substratum, at an attainable depth below the surface, causes the water to sink downward as subsoil water. On the other hand

an impervious substratum at a reasonable depth, having an inclination somewhat the same as the surface, will intercept the water sinking through the loose surface formation. The downward pressure of the water, together with the impenetrability and inclination of the substratum, will cause the water to percolate in the same direction as the trend of the watershed and channel of the stream. As long as the substratum continues impervious, inclined and sufficiently near the surface, an underflow, the extent of which depends on the other conditions already discussed, will be found to exist.

(To be Continued.)



EXTRA FINE FURROW IRRIGATION,
But just as cheap and easy as any. Land graded to uniform slope, streams all regular in size and flow.
Utilizing ground between orange trees.

THE ART OF IRRIGATION.* CHAPTER X. IRRIGATION BY FURROWS.

BY T. S. VAN DYKE.

IN orchard work many of the best irrigators run but two furrows to a tree, one on each side, the first year, two on each side the second year, and so on until the third or fourth year when the whole intervening space is filled. Others gridiron the whole ground at once and lead the roots of the trees away from the trunk and out into the warm, sunlit soil as rapidly as possible. This is the better way where one has the water and time. And where one wants to make the place pay its way from the start one can raise a large amount of produce in the space between the young trees without any perceptible injury to them. This is now a common practice in many places

^{*}Copyright 1895, by T. S. Van Dyke.

though some condemn it. Theoretically it injures the trees by drawing too heavily on the soil. Practically it does nothing of the kind and the difference cannot be seen. Of course the extra product is an extra drain upon the fertility of the soil, and will hasten the time when fertilizers must be used. But most all ground is rich enough for young trees, while no ground is rich enough for old ones in full bearing. The time will come when you must fertilize anyhow for large yields of high-grade fruit, and in the meantime by using the ground you have some returns before your orchard comes into bearing. ground is well irrigated and cultivated the amount of stuff that can be raised between the rows under a warm sun without apparently injuring the trees is wonderful, and helps out many a poor man in California. But it must of course be done with care and good judgment.

REGULATING THE FLOW.

When everything is ready and the water turned into the distributing flume there is little to do but regulate the gates. is not much of a task, even the first time, for they may be set very nearly by guess. But you should go along the line to and fro several times watching the flow closely so as to get it as even as possible from every hole. It is not easy to judge of the amount of flow by the size of the stream, for velocity is as important a factor as thickness. But by watching the discharge a while, and the way the water flows down the furrows you will soon have the gates set so as to insure quite an even delivery to each furrow. Give the small boy of the ranch a half dollar to let them alone and you will have little or no work with them the next time.

With hoe in hand go over the field a few times and see that the furrows are all right. Some think bare feet and legs essential to thorough irrigation. So they are for shiftless people and for flooding they sometimes are in the best work. But for small furrows, after you have everything working right, you will need nothing but slippers and will hardly soil them.

You need not spend any time coaxing water down a furrow. This will do in a little garden patch, but on a tract of any size it is an endless job. If the water does not run fast enough after a fair trial open the gates a little more. But be

careful how you decide it is not running fast enough. Patience is here the cardinal virtue. The water may seem to drop out of sight too soon and yet be creeping along below and filling up toward the top. Give it at least twenty-four hours to go 660 feet. If your soil has stood the test before mentioned the water will probably get through, though very slow at the start. Once acquainted with the vagaries of your soil you will have little trouble. You will know whether to crowd on more water at the beginning and force it through or to wait and let the smallest streams work their way. When you can have the irrigating head long enough the latter course is most always the best. If limited to a short run you will, of course, have to force it through with larger streams. length of the run will be considered further on.

THE WASTE WATER.

To insure good wetting of the lower end of the tract some waste must run off. If the tract is well laid out this should not exceed five per cent and on many places it is almost nothing. But even a little may be considerable in amount and it is well to provide some way to utilize it. Considerable firewood, as well as shade, and windbreak for things like oranges that do best in almost dead air, is grown in this way in some of the dry sections. Where the waste amounts to anything and is run in a ditch along the outer edge of trees it will generally keep the roots at home instead of allowing them to rob the main tract as they are apt to do if left to shift for themselves. In the dry countries no unnecessary trees or large shrubs should be grown around the irrigated tracts, unless in some way supplied with water to keep the roots at home. In a garden the waste may be used for berries, a small alfalfa patch for the cow or chickens and many other things. As it carries considerable of the fertilizers that may be used, it should never be allowed to run away as it generally is. At the same time provision for waste ditches should be made as water is at any time liable to escape under careless management and do damage.

SMALL STREAMS BEST.

One who has never watched them for a whole season can scarcely believe the work done by streams so small that they never run muddy, never cut and never build But if the soil is close enough to permit it, they are as much superior to all other modes of applying water as a long slow rain is to a cloudburst. In its present perfection the system was first worked out at Riverside, California, by people with the means, the time and the inclination to experiment. It has worked its way around wherever it is possible to apply it, and its value over all else on fine soil can be no longer questioned. The only exception is that before given, of alfalfa and some other crops on a very large scale, where it is simply a question of economy in handling the water and not one of results.

"Yes?" I replied. "We carry twice that load on trees in California and pull them through with ninety per cent of first grade fruit on."

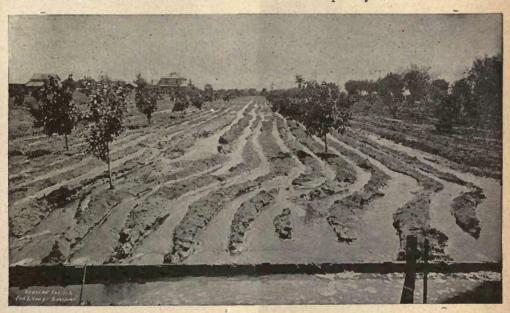
He wheeled around on the seat and stared at me from head to foot until the

horses almost ran into the ditch.

"That's correct," drily remarked the editor of The Redlands Citrograph, one of the oldest and most practical fruit growers of Southern California, who sat beside me.

"They are suffering for water. They look leathery," I continued.

He wheeled around with another look that said as plainly as words:



A SPECIMEN OF VERY POOR FURROW IRRIGATION.

Amount of water about five times too great; uneven feed of water into different furrows. Such work washes off the fertilizers, leaches the natural fertility out of it and is in every way bad, because wholly unnecessary.

How far people may drift from this easy and effective work and lose money without knowing it, is well illustrated by the following:

At Phoenix, Arizona, in June last, I was shown an apricot orchard by the owner, who was driving. As we came up to it I could see fifty yards away that the fruit was runty and tough. The soil, climate, and all natural conditions were apparently the very best for the highest perfection of the apricot.

"Those trees are too heavily loaded and I haven't had time to shake any off," remarked the owner.

"Why, what asylum have you just broken loose from?"

Then he added with a sneer. "They have had lots of water."

"They are suffering for water all the same," remarked the editor. "There is no mistaking the leathery look." Then he got withered with a look of terrible contempt.

"That furrow on each side the trees had about fifteen inches of water fired down it; didn't it?" I asked. It showed plainly what the answer would be.

"About that," he replied.

"And it ran muddy at once, and in this

fine soil coated the bottom and sides of the furrow with a fine slime?"

"Y—yes;" he answered. He need not have taken the trouble, for the dried slime spoke for itself.

"And when it dried, instead of cultivating and breaking it up you left it to crack."

He did not answer this. The furrow answered for him.

"And when it dried and cracked until it gotdry enough you fired more muddy water down it and puddled the cracks. And you let it dry and form new cracks and then puddled them again. And you repeated this process several times a year for two or three years until it now comes near being a cement ditch. Consequently a tree may stand within three feet of it and get moisture enough to carry half a crop fairly well but not get enough evenly distributed through the soil to feed up to the point necessary to carry a big load up to first grade."

"That's what's the matter," remarked the editor.

The owner did not say much, but the chances are he is still running that field in the same way without a particle of cultivation, keeping the same old furrows and puddling the new cracks in them as fast as they form. The number of people who can comprehend the folly of working out anew for themselves things that for years have been worked out for them somewhere else is very small.

By a long run of a small stream instead of a short run of a big one, and with good cultivation of the whole, breaking up the furrows each time, these trees would have done as well as any trees in California. The soil was fine enough to permit it, and it would have taken far less water to produce twice the crop and make it nearly all first grade.

EXPERIMENTS IN CALIFORNIA.

On a place where I once spent three years, and took considerable interest in the irrigation because I was depending on it for fruit, the watering was all of this kind. It was in 1879, and little was then known about irrigation in California, the methods being of the crudest types. But it would not have paid to use anything better in this case, for there was no market for the fruit and it was raised only for home use.

A little dam across the creek furnished a head of about twelve inches for six hours every three days and there was nothing to do but go up and pull out the shingle that formed the gate. I soon found that the trees had grown balls of thread roots close up to the ditches and that the water soaked but a short distance to the sides. The fruit was very good provided there was not much of it. When there was it was small, sour and flat. This was in a region where the rainfall was about twenty inches, and trees would live and bear something without any irrigation. But it was then plain to me from some experiments I made that, while the trees got drink enough through the skeins of thread roots they had formed along the ditches, there was not enough ground sufficiently wet to enable them to feed the tree properly when well loaded.

Many such little ditches are still found in out-of-the-way places, and they bear well enough for home use but not enough for heavy profit. And the results look very fine to one who has never known what it is to market a crop of fruit. When one learns that nearly all the profit is in the first grade, and that the second hardly pays expenses, while the third had better go to the hogs than ruin the reputation of the grower and his locality by going on the market, one begins to find out where he is. And if the place has a mortgage on it he may be behind on the interest, while some one, with conditions not as good, is making large profit out of every acre.

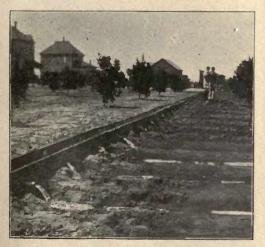
In 1878 I experimented with these small streams on adobe soil of the blackest and stickiest kind. I wanted vegetables and could get them only by raising them myself. I was limited to a windmill from a very deep well, making the stream small and slow. But I was surprised to find that a very small stream soaked sideways with great rapidity, and that nothing was gained by increasing it so long as it flowed at all. All it wanted was time and this it had to have no matter how long.

On some soils, however, this will be an absolute failure. In 1877 I tried the same thing on some alluvial soil of very fine appearance and very rich. But the water fell through it as fast as it was turned in, and if the stream was increased enough to force its way along then it puddled the sides and bottom and still re-

fused to soak far enough to the sides to be of any use for anything unless planted almost on the ditch. A tree could have stood within two feet of it and got no water until it sent roots to it and then would get only drink, the ground remaining too dry to enable it to feed. flooding is about the only way to handle such ground.

A NEW JERSEY INSTANCE.

My first experiment with irrigation was in New Jersey, in 1856, at the age of four-There was a very dry spell and we had in the garden a new variety of sweet corn, to which I was very much attached and I tried to save it. The gardener and my father both told me it was no use to try to water it, but I went at it with a pail and packed water from the well for nearly half a day and poured it down the rows. Then the hired man started in to help me and we gave it what seemed a The result was a practical good wetting. failure, though there was more corn than there would have been had we not watered Looking at the same ground years after it was easy to see what was the mat-It was a loose red shale soil lying upon fissured rock. This rock was thoroughly dry, for we did not begin to water until all hope of rain, enough to save the corn, was past. The water dropped through the loose texture of the soil and the fissures of the bed rock drank it up as fast as we could pour it in. The quantity



DISTRIBUTING FLUME FOR FURROWS.

that seemed so great to us because pumped from a deep well and packed some fifty vards by hand was really but a trifle compared with the needs of the soil. Assuming that we carried five gallons a trip with two pails from the pump to the patch, and made thirty trips an hour for five hours, which is more than we did, we put on 750 gallons. This is a trifle more than one-eighteenth of an inch for twenty-four hours, or one-ninth for twelve hours, or one-fourth for about five hours. It was not possible for the water to soak sideways and upward until the crevices in the rock had been either filled or the bottom of the furrows puddled so as to stop the downward flow. The short dashing doses that we inflicted upon the suffering patch had no such effect. The ground either needed flooding or a long run of streams of a third to half an inch and perhaps more. While we made lots of fuss, mud, and slush, the roots of the corn, which were not trained near the center of the furrows, but went straight down, got little of the moisture. Add the fact that the corn was twisted all night after it was in tassel, while the water from the deep well was very cold, and it is easy to see the cause of failure. Many would conclude from this that irrigation in New Jersey was a failure. On the contrary, few States need it more or would show much better results where warm muddy water from the streams could be economically brought upon the soil. saw this tried in 1893 in a garden at Mont Clair, and showed a friend's gardener how to run small streams. The season ruined all the neighboring gardens, but this one was loaded with produce, of a better quality and earlier than they had ever before seen. The bearing season for beans, melons, and some other things, was extended fully two weeks by it.

(To be Continued.)

NOTE TO CHAPTER X.

NOTE TO CHAPTER X.

[There is no objection to any paper copying any part of this that will be of use to its locality, provided due credit is given The Irrigation AGE and not more than two chapters published consecutively so as to interfere with the sale of the work in book form.

If any one doubts the efficacy of printed precepts in a practical matter like this, let him write to any of the old settlers of Chula Vista, in San Diego County, California, and ask what was the effect of a lecture given the settlers by the author, at the schoolhouse there in June, 1889. Ask if they did not at once reverse their enthre methods of irrigation and if they do not attribute to that change the great success they have achieved.]

PRACTICAL IRRIGATION IN KANSAS.

BY C. D. PERRY.

A N adequate supply of water being the first requisite for successful irrigation, I will first mention the four sources of supply in Western Kansas in the order of their relative value as I consider it after eight years of close study of the question.

First, and by far the greatest source is from wells sunk into the sheet water, storing this water in reservoirs, using wind or mechanical power according to the quantity needed. The amount of water that can be obtained in this manner exceeds many times the supply from all other sources combined, and it will be especially valuable because it will always be under the control of the owner of the plant.

Second, the surface flow of rivers, conveyed through canals and ditches, is perhaps the next largest source of supply but is closely followed by the third source, the underflow of rivers and streams. I should not be surprised if this source would even exceed in quantity the surface supply of

rivers.

Fourth, the storage of storm waters by damming ravines and draws. source, owing to the unreliable rainfall of our section, is not of very great importance.

Only small strips of land along the streams can ever be irrigated by their waters, but the bulk of our best lands, the second bottoms and uplands, will forever depend upon wells, and the value of the lands will be in proportion to the depths of the wells.

1887 was a dry year, as many of my farmer friends remember. This was the third year that I, a city chap, had been on that ranch of ten thousand acres and those three years comprised the total experience of my life in farming. In that time I had seen the seed of three crops planted in soil that I prided myself was as good as any. Of those three seedings not one matured a crop. Beginning with that year, the discouraged farmers about me left the country, one by one.

That was the summer of the fateful July winds that parched the magnificent corn everywhere approaching maturcrop,

ity from Englewood to Topeka. That summer, also, the Santa Fe, the road which has been such a factor in the upbuilding of the State, and which as a corporation has had its boom and its collapse unequaled by that of any other institution within our limits, was engaged in running a preliminary survey southwest from Englewood.

This work brought to light the fact that the bed of the Cimarron river, six miles south, was thirty-two feet above the level of the ranch. Realizing the futility of dry farming, we determined about the middle of July to build a gravity canal of sufficient capacity to irrigate their farming

By October . such a canal was completed. It was ten feet wide on top, five feet wide on the bottom, and eighteen inches deep, with a fall of two feet to the mile. was eight and a half miles long, three and a half miles squarely away from the river to the south line of the ranch and five miles around the western and northern rim of that beautiful valley comprising three thousand acres of irrigable land in the eastern half of the ranch.

At first it was attempted to take water · out of the river without a dam. wide channel and shifting sands rendered that impracticable. A stone dam was therefore built but was soon washed out. After two and one half years of struggle and disappointment it was decided to put in a sheet piling dam 422 feet long; 2 x 8 x 12's were driven down, leaving eight inches above the bed of the river. Timbers were bolted on each side and 600 loads of rock thrown in on the lower side of the dam and finally an apron eight feet wide was bolted on to lower part of 160 feet of dam where the main channel was.

The first time the water was turned in, a stream, one foot deep and sixteen feet wide, was fourteen days going through the eight and a half miles dry ditch. takes but seven or eight hours.

Faulty engineering had to be contended with in laying out the canal, the natural contour of the land not being followed closely enough.

Where the draws and the ravines came down from the hills only one bank was built, thus forming ponds on which the winds made waves that cut out the banks. This was remedied by making the bank strong enough to be split and on which the water could be carried with a drain under the ditch to lead off the rainfall. In other places the ditch was rebuilt around the pond next to the hill. Some of the hills had to be made heavier and after two or or three years the banks settled and were grassed over.

I have thus briefly outlined for you our troubles in building the dam and canal, but even after the waters had been brought to the land, our troubles were not ended.

DISTRIBUTING THE WATER.

The main laterals and distributing ditches had then to be built so that the land could be evenly watered. The literature of irrigation was very limited seven

years ago.

THE IRRIGATION AGE was not published and the Kansas Farmer did not then devote from a column to a page to the subject. Our State Board of Agriculture did not then set apart a day or a part of a day to the discussion of this question. We had only the scanty government reports and Stewart's Manual on Irrigation to aid us.

To say that mistakes were made is to give you but a faint idea of our discouragements. We often thought it ought rather to be called an "irritation" ditch.

A look over our alfalfa fields will show the traces of four abandoned systems by which we attempted to distribute the water, before the present system was adopted.

Before describing it, let me say, I can conceive of no way of having absolute control of the water at all times except by the basin system, which requires very level land and a great deal of very hard work.

According to our system, the distributing laterals, either for running the water down the corn or orchard rows or for spreading it over on alfalfa or grain field, are all laid out to a uniform grade of one inch to 125 feet of length of lateral. This grade has been adopted as the result of experience.

We have found that six-inch banks and a canvas dam to raise the water that much above the natural surface, allows us to take the water out along the desired length of ditch of about 400 feet with a margin of safety. With a fall of only one inch to 125 feet it is necessary to raise the water only three inches at the dam to back it up so that it can be taken out for 375 feet.

This margin of safety in a six-inch bank, allows us to make holes in it about sixteen feet apart and to divide the water in the lateral so that it will be evenly spread down over the land between this lateral and the one next lower down in the field.

By laying out the laterals on this regular grade, the lands or sections of the field to be irrigated are made irregular in width because the slope of the land is irregular. In order to determine how far apart these distributing laterals shall be, you must find out how far you can run the water economically over the land. In the case of hoed crops and of orchards, this distance will probably be greater than in the case of those crops that are flooded.

Most of you have observed how short a distance the stream of water pumped by an ordinary windmill will run down a furrow before it is all absorbed by the earth.

No matter how long you pump, the water never flows any farther. The distance the water will run is determined by three factors: First, the texture of the soil; second, the slope of the land, and third, the head of water at your disposal. However, I am not giving you a general rule for your guidance. The conditions are different on each farm, frequently on different fields of the same farm, more especially on bottom and second bottom farms, where the soil is mostly "made land."

I am only giving the sizes of laterals and of irrigating "lands" as we have them on Claremont ranch. Our distributing laterals are from three to five feet wide, rounding on the bottom and carrying water from six to ten inches deep. We aim to make our irrigating "lands" at the start about 250 feet wide. But in running the laterals a quarter to a half a mile, the "lands" might be made to vary from 150 to 400 feet, according to the slope in the field.

These distributing laterals are laid out with a surveyor's level on a tripod. One person managing the level and another carrying the rod and finding therewith the proper points of the proposed line

every 120 feet on comparatively level land. But if the land is irregular the points should be taken at about half that distance apart.

The man carrying the rod marks these points with mounds of dirt, thrown up with a shovel, which serve to guide the

one who plows out the laterals.

These laterals at the given fall vary but little from the level contour lines of the land and so run at almost right angles to the greatest slope. Therefore, when the water is turned out of the lateral it runs away from the lateral at almost a right angle to the next lateral below and at a speed varying with the slope of the land, the texture of the soil and the head of water.

These questions of size of laterals and of irrigating "lands," each man will have to settle for himself. This he can readily do in a small way before laying off his field. But if that part of the land being irrigated just below the lateral being used absorbs from fifteen to twenty inches of water, while the lower side is getting four inches (the amount necessary for one watering), there must be a great waste of water, and damage may be done to that part of the crop receiving too great an amount.

If this is the case, the distributing laterals are too far apart. Having these contour distributing laterals built, you can now ordinarily locate the supply lateral from the canal or reservoir, as the case may be, along the sides of your field crossing the starting points of your distributing laterals.

We use a portable canvas dam to divert the water from the supply lateral into the distributing lateral. The same kind of a dam is used to check the water in the dis-

tributing laterals.

Constructed on this plan one man on our ranch is enabled to spread the water and irrigate 1,000 acres once, and 300 acres of this two and three times.

To wet the land evenly from ditch to ditch it must be graded down the slope, so that the water will not run around hillocks or too much remain in hollows. This grading we do with a common slip scraper, or, preferably, with a Shuart land grader. We have a home-made leveler which we use in the place of a harrow which levels the minor inequalities, and a home-made A-shaped tool for cleaning out

the ditches and laterals. As a hill torn down or hollow filled up is a permanent improvement and lessens the amount of water used and increases the crop, it always pays to do this work.

Beginners generally use too much water. The best crops that we have raised had but one watering and that in the fall. A thorough wetting of the subsoil, according to our experience, is what is necessary.

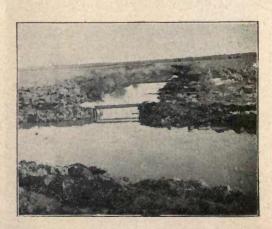
Corn will never, in my opinion, be a profitable Western Kansas product, but in Kaffir corn we have a crop for us equally valuable. For seven years past a wail has gone up from Western Kansas. As the hot winds blasted the crops, the people

blasted the country.

The one hundredth meridian line crosses our land, that mysterious line from beyond which all settlers are warned, and few indeed are they that have returned from there with pocket-book intact. But looking back over these same seven years I can truly say that irrigation has given us crops, good, better, best, according to how well our farming and watering has been done. I have many times thought that if I could irrigate the prices up as readily as I can irrigate the crops up, great would irrigation be indeed!

You have been told, year in and year out, of the beauties of irrigation, and as you have listened to the glib oratory, it has seemed to you an easy thing to irrigate land, but I have tried to tell you that it takes good hard work, it takes patience and it takes skill and brain work to get your water supply and then to use it so that the best re-

sults and profits will follow.



CANAL AND LATERAL ON THE CLAREMONT RANCH IN KANSAS.

HISTORY OF IRRIGATION IN NEBRASKA.

By I. A. FORT.

THE following is a brief history of the inception and commencement of the construction of irrigation canals in that part of America lying east of the Rocky mountains.

During the past three years of active discussion of the irrigation questions, we have read and heard of the merits of different canal systems of the United States, yet the pioneer irrigation country of the great plains of America has re-

mained silent.

Lincoln County, Nebraska, claims precedence in the leadership of the irrigation movement of the great plains. As far as can be learned from careful inquiry the first irrigation canal constructed Americans on the territory designated was built by a gentleman now residing in North Platte, Nebraska, by the name of Washington M. Hinman. Mr. Hinman first commenced excavating a small canal in the month of March, 1863, taking his water out from the south bank of the South Platte river, at a point about six miles west of old Fort McPherson, now in Lincoln County, Nebraska. In the spring of 1864, another resident of that vicinity, John Burke, of Cottonwood Spring, near the same military post, commenced the construction of another canal a little below Mr. Hinman. Both of these canals were used. Mr. Hinman's in both the summer of 1863 and 1864, and Mr. Burke's during 1864 and 1865, and a large amount of valuable farm and garden produce was gathered and sold to the soldiers and residents of the post, but the Indian war, breaking out in 1864, made farm labor and irrigation both difficult and dangerous and no crops were planted on the lands subject to irrigation by these ditches after 1865, and the canals were abandoned.

A CORPORATION ORGANIZED.

In 1870 there was a stock company formed in North Platte, Nebraska, and a small canal was excavated that obtained its water from the South Platte river, at a point about four miles west from North Platte, the head gates being located on

the north bank of this river. This canal was capable of irrigating about three thousand acres, situated in and about the town of North Platte. Only three crops were grown on the lands thus watered by this ditch. As the rapid growth and development of the free range and stock interest during these earlier years entirely eliminated all interest in everything pertaining to agriculture by the cultivation of the soil in this vicinity the canal was abandoned. But North Platte still retains some of the benefits derived from this work, in the growth and development of several long rows of magnificent trees now standing that were planted in those years along the line of this canal. In 1871 the soldiers of Fort Sidney, Nebraska, constructed a small canal that was used to water the trees and also the post gardens. This has since been abandoned also, owing to the non-occupancy of the fort by the United States troops.

In 1883 a promoter, by the name of E. M. Day, of North Platte, organized a canal company at this point, that after several changes in its organization finally completed a canal, now known as the North Platte Canal, that was twenty miles in length and was capable of irrigating twenty thousand acres of land. This canal is one of the permanent works of this section and has been the means of educating the people of Nebraska to the great benefits and value of irrigation. In 1887 the people of Scotts Bluff county. Nebraska, commenced the construction of irrigation canals, and in 1890 the Culbertson canal of Hitchcock county was proposed and commenced. Since this date the irrigation sentiment has been steadily increasing, and at the present time, with the canals now completed and under construction that will be finished before 1897. Nebraska can claim to have over a million acres that are susceptible of irrigation, by means of the canals, that will insure a permanency to her agricultural population and guarantee bountiful crops in all years to come.

ALKALI.

DEFINITION AND METHODS OF TREATING IT.

BY E. M. SKEATS, OF NEW MEXICO.

WHAT is alkali? Webster's dictionary says "a salifiable base, having in a greater or less degree a peculiar acrid taste, the power of changing blue vegetable colors to green and the color of turmeric and rhubarb to brown. Potash. and ammonia are the leading alkalies." That is more or less answer a chemist would give to the question, but since irrigation has become a popular science the definition requires enlarging. To an irrigationist alkali has come to mean any efflorescence which may form on the surface of the ground. irrigationist divides this alkali into two classes, one he calls "black alkali" which is very harmful to vegetation, the other he styles "white alkali" and he considers it moderately harmless.

The "black alkali" consists in great part of the carbonates of potash or soda; these have great solvent power on vegetable matter, turning it black and killing live plants in contact with it. It is decidedly dangerous and is a true alkali.

But with regard to "white alkali" the name is misleading as very frequently the white efflorescence contains no alkali at all, according to Webster's definition, but may consist of any salt which is soluble in water; it may be a valuable plant food, or it may be a poison, or it may have no effect at all on plant growth. It consists almost always of the mineral matters in solution in the bottom water. According to the nature of this water (the shallow well water of the neighborhood) so does the nature of the "alkali" vary.

I believe it is a popular idea that "alkali" comes from the soil. Indirectly of course, it does; but not necessarily or generally from the local soil but from soil through which the bottom water has flowed. In very few cases will you have any alkali at all on the surface unless you have a bottom water within eight feet, and the alkali will consist simply of the solids of this water.

Soil is porous and like a wick and, according to whether it is fine or coarse, it will draw up water to a greater or less height. A very sandy soil will draw it up

about one and a half to two feet, while an adobe will draw it up four or five feet.

Suppose you have, then, an adobe soil and your well shows water within four feet of the surface, and the water contains a large proportion (not necessarily a large amount) of carbonate of soda, you will have "black alkali" in your ground and will have to be very careful how you treat it. This is the case in a few parts of California, in parts of India, and in many parts of South America.

Now, suppose that below you is a district of gypsum beds and that your bottom water flows through these. It dissolves some of the gypsum or sulphate of lime, the sulphate of lime and carbonate of soda in the water change and form carbonate of lime and sulphate of soda. Your friend who, perhaps, has property below these gypsum beds, does not find the same difficulty with his garden that you do. His well perhaps shows the water but two feet from the surface, but the efflorescence on his ground consists of carbonate of lime and sulphate of soda, both of which salts are harmless.

Take another example: Your land is in the Pecos valley—a gypsum formation your well shows the water seven feet from the surface. The water contains sulphate of lime and magnesia and some common salt.

Through the dry season you have no alkali or efflorescence on the surface, as the soil cannot draw the water seven feet. But a rain comes, or you irrigate, and the soil is wetted down to where it can draw The water from above the bottom water. mixes with that from below and dissolves much of the lime, magnesia and salt which the latter has left two or three feet below the surface. This is now drawn farther up and appears on the surface after the sun has dried it. It is thus that an efflorescence can appear when the bottom water is as much as eight feet from the surface, though the soil can only draw it a little more than four feet.

In this instance the efflorescence consists of sulphate of lime and magnesia and common salt with no true alkali, and

except when it is allowed to become very strong it is harmless; it even acts as a fertilizer.

Again suppose your land is in Egypt, your well showing the water three feet from the surface of a sandy soil. After a rain or irrigation an efflorescence will appear. The water in the well contains but small quantities of carbonate of lime, carbonate and sulphate of magnesia, sulphate of potash, chloride of soda, and traces of phosphoric acid and ammonia. The efflorescence will consist of the same and act as a very fine fertilizer.

In general the nature of the alkali will be governed by the geological strata of the district. Where there are granite hills and valleys with rich clay soil, the black alkali may be feared, but the soil will be extremely productive. Parts of California and India exemplify this.

In a limestone region the alkali will be probably carbonate of lime and there is likely to be some common salt and magnesia. It will be harmless, but the soil will not be as rich as the last. The district east of El Paso may be taken as an example. It is in the cretaceous with granitic formation underlying. Where the strata is broken here the soil may be more like the last.

In the Mesilla valley and the Pecos valley we have districts in the cretaceous underlayed by the gypsum. Where there is efflorescence it consists of carbonate of lime, sulphate of lime, sulphate of magnesia and common salt. The abundance of sulphate of lime precludes the possibility of the presence of "black alkali."

I trust that I have made it clear that we need a revised Webster for irrigation districts.

IRRIGATION IN SOUTH DAKOTA.

By J. M. GREENE.

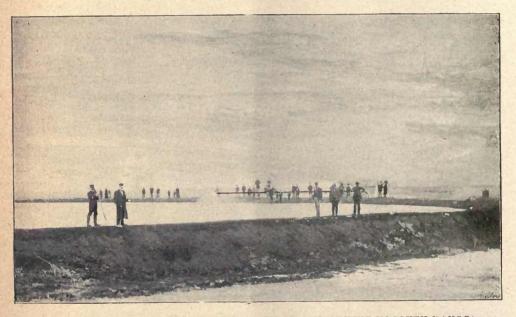
THE irregularity of rainfall, or the entire absence of it at times, created the necessity of irrigation. Water applied at the proper time insures success, and the uncertainty of the supply coming through natural channels has made it necessary to procure it by artificial means. It is not the purpose of this article to go into the many advantages possessed by irrigation wherever practiced, but to deal with it in one section only.

The writer has looked over the irrigation districts of Colorado and California. and in these States the development of irrigation in the past ten years proves conclusively that it is a profitable and permanent industry. South Dakota has just awoke to the fact that there is no area of corresponding magnitude in the world that can be so cheaply irrigated as what is known as the artesian basin, which underlies a large portion of the state; cheap for the reason that every quarter section of land in the artesian basin can be supplied with more water than is needed for irrigation or any other purpose, by drilling an artesian well varying in depth, according to locality, from five hundred to one thousand feet and giving an unsupported flow of water above the surface of the ground from six inches to sixteen feet high. Two years ago irrigation was almost unknown in Brule County, South Dakota. One year ago some experiments were made by drilling wells for irrigation and the results were so satisfactory, both from the standpoint of profits and cheapness of development, that during the coming season 7,000 acres will be irrigated. The beauty of the artesian well system of irrigation is that every farmer can own his own well and water, and be independent of any and all water companies. He can use the water when and where he chooses. He can construct a reservoir on the highest ground on his farm and turn his well into it there. Reservoirs can be cheaply constructed by the farmer himself. If he has, for instance, a six-inch well and desires to irrigate 1,000 acres he should have a reservoir that would hold five or six acres of water. To construct such a reservoir it should be laid out in a circle; take all the sod off where the bank is to be made, plow up the center of the circle, and haul the loose dirt into the bank with common scrapers, giving the bank from one-fourth to one-sixth pitch, building the banks

from six to eight feet high. An excellent and cheap remedy to prevent the waves from washing the banks is to riprap them on the inside with willows, tying the willows to the bank with No. 12 galvanized wire attached to stakes and driven into the bank. If care is taken in selecting live willows and at the proper time of year, a sufficient number of them will grow to hold the bank of your reservoir from ever washing. There are a number of other ways to save the banks from being destroyed by waves, but I consider that where the willow can be had cheap enough they are the best.

The writer is not a theorist as he is developing a 640 acre irrigated farm in Ola Township, Brule County, South Da-

large stream of water, the reservoir system increases its value and efficiency by furnishing all the water needed to irrigate and at the proper time, when the water affords the most benefit to the soil. It also has the advantage of being a great saving of time. The water that can be let out at one time from the reservoir that I have just constructed and described will cover 320 acres of land one inch deep. From my experience so far, and the way my land lays and ditches are constructed, it will take two men four days to distribute the water over this amount of ground, while some of my neighbors who have stronger wells than mine, but no reservoirs, cannot do the same amount of work in five times as long.



SECTION OF RESERVOIR ON IRRIGATED FARM OF J. M. GREENE IN SOUTH DAKOTA.

The reservoir has been constructed on the plan stated, covering seven acres of ground; the banks are eight feet high on the outside, giving about that depth for water on the inside; the gates or outlets are protected with galvanized screen wire, as it is intended to stock it with fish in the spring. The reservoir has been full of water for the past two months, during which time a number of heavy windstorms have occurred without damage to the banks, which proves the willow rip-rap a success. The well that supplies the reservoir is 1,030 feet deep, and flows 800 gallons of water per minute, and although this of itself makes quite a

There need be but very little expense to a farmer in constructing his reservoir and ditches in South Dakota. He can do this work in the winter time when he has very little else to do, by plowing the ground thoroughly before the hard frosts of winter occur. A great many miles of ditches were constructed in this county during the months of January and February, also four or five reservoirs, which goes to show that the industrious farmer can do this work all himself during the winter time, and the only expense or actual money needed in developing an irrigated farm in the artesian belt of South Dakota is for drilling his artesian well.

IRRIGATION LEGISLATION.

RIGHT OF WAY FOR CANALS AND RESERVOIRS OVER GOVERNMENT LANDS.

BY L. H. TAYLOR, OF NEVADA.

SECTIONS 18, 19, 20 and 21 of the act of Congress approved March 3, 1891, entitled "An Act to repeal timberculture laws, and for other purposes," grant the right of way through the public lands and reservations of the United States for the use of canals, ditches and reservoirs heretofore or hereafter constructed, upon the filing and approval of the certificates and maps therein provided for, but the applicant for such right of way acquires no rights until said maps, etc., are approved by the Secretary of the Interior. and such right attaches from the date of approval. In this the law is defective, for in the interim between the filing of the application and its approval the land is subject to entry, and being entered by anyone unfriendly to the project the applicant has no recourse but to buy out the entryman, or to condemn the right of way under the law of eminent domain, and if the applicant be a private individual and not a corporation he has not this latter resource. So the act above referred to should be amended so as to provide that after approval of any application thereunder, the right of way granted shall refer back to and attach from the date of filing said application—or better yet, from the date of beginning of the necessary surveys. the same as a homestead filing refers back to the date of settlement.

Another amendment which appears necessary to this act is one providing for its extension to unsurveyed as well as surveyed lands. It may be argued that on unsurveyed lands there is no means of properly describing the right of way, but this can be done in the same manner as in the case of mineral entries.

It may often happen that all or a part of a reservoir site or canal location is upon unsurveyed land, and this may be occupied by a settler at any time before such canal is constructed or the reservoir filled with water, and thus a great hardship worked upon those engaged in such construction, or the enterprise be stopped altogether.

Unhappily, there are only too many men on the lookout for just such opportunities to blackmail legitimate enterprises, and it should be the function of the law to afford protection against such. So it is to be hoped that this matter may be brought to the attention of, and acted upon by Congress at its present session.

The Court of Appeals of Colorado holds that an appropriator of water of a river cannot enjoin another subsequent appropriator of the water of a tributary below the point of the first party's location, from using the water of the tributary on the ground that such use reduced the quantity of water in the river so that lower appropriators, whose appropriations were prior to that of the complainant, did not receive the amount of water they were entitled to unless the first party supplied the deficiency from his share of the water, where the prior appropriators are not made parties to the action.

Larimer & Weld Reservoir Co. v. Water Supply & Storage Co., 42 Pacific Reporter, 1020.

CONSTRUCTION OF CONTRACT WITH WATER COMPANY.

A contract between certain parties and a water company gave the former the option to buy from the latter land described in the contract, at a certain date, "in accordance with the rules" of the company, at a price stated. The Supreme Court of California held that such parties were not entitled to any water rights, in the event of their election to buy, in the absence of any rules by such company entitling them to such rights. The fact that such company had adopted a system of allowing certain leases to be made with the privilege of purchasing, "the purchase price of the land to be in full payment of, and to entitle the purchaser to, a permanent water right to the use of the water from the company's canal, corresponding to the number of acres bought by him," etc., did

not constitute "rules" of the company, such as would entitle these parties to any water rights with the land.

Giddings v. Land & Water Co., 41 Pa-

cific Reporter, 788.

CONTRACTOR'S LIEN ON IRRIGATION DITCH.

The Supreme Court of New Mexico holds that, where a contract provides that payment shall be made for the work on final estimate and certificate of an engineer approving the work, and a showing that the work is free and clear of all liens, and after the final estimate is made, and the certificate is procured, the contractor being refused, files his lien, the fact that subcontractors subsequently file liens for work will not defeat the contractor's lien.

Ford v. Springer Land Association, 41

Pacific Reporter, 541.

DAMAGES TO RIPARIAN OWNER.

Where the water of a stream running through a farm is taken by a village for its water-works, the owner is entitled, not only to damages from being deprived of the water for farm purposes but, where he has laid out part of the farm in village lots for sale, he is entitled to damages from being deprived of the opportunity to sell water rights to purchasers of the lots.

Bridgeman v. Village of Hardwick (Supreme Court of Vermont), 32 At. Rep.,

502.

RIPARIAN RIGHTS.

The right of a riparian proprietor in or to the waters of a stream flowing through or along his land is not the right of ownership in or to those waters, but is a usufructuary right, a right, among others, to make a reasonable use of a reasonable quantity for irrigation, returning the surplus to the natural channel, that it may flow on in the accustomed mode to lands below. If his needs do not prompt him to make use of them, he still has the right to have them flow onto and along and over his land in their usual way, excepting as the accustomed flow may be changed by the act of God, or as the amount of it may be decreased by the reasonable use of upper owners and riparian proprietors. But none of his rights to put the water to legitimate uses is lost by mere non-user. rights are not easements, nor appurtenances to his holding. They are not the rights acquired by appropriation or by

prescriptive use. They are attached to the soil, and pass with it, and may be lost only by grant, condemnation, or prescription. With any use or diversion of the water, after it has passed his land, the upper riparian proprietor, having no ownership in, and no longer any rights to it, would have no concern. None of his rights would or could be impaired thereby, and without such an impairment he would be without injury and, consequently, without cause for complaint or redress. right extends no farther than the boundary of his own estate. He cannot complain of the mere facts of the diversion of the watercourse either above or below him, if, within the limits of his property, it is allowed to follow its accustomed channel.

Hargrave v. Cook (Supreme Court of

California), 41 Pac. Rep., 18.

The Supreme Court of California holds that a lower riparian proprietor has no right, independent of contract, to go on the land of an upper proprietor to return the stream to its original channel, when it has been diverted therefrom by natural causes.

Wholey v. Caldwell, 41 Pac. Rep., 31.

ORAL PERMISSION A MERE LICENSE.

An oral permission given to divert and use water from a stream is a mere license, which is revocable, and does not vest any estate in the land. There is a clear distinction between the effect of a license to enter lands, uncoupled with an interest, and a grant. A grant passes some estate of greater or less degree, must be in writing, and is irrevocable unless it contains words of revocation; whereas a license is a personal privilege, can be conferred by parole or in writing, conveys no estate or interest, and is revocable at the pleasure of the party making it. There are also other incidents attaching to a license. It is an authority to do a lawful act which, without it, would be unlawful, and while it remains unrevoked is a justification for the acts which it authorizes to be done. It ceases with the death of either party, and cannot be transferred or alienated by the licensee, because it is a personal matter, and is limited to the original parties to it. A sale of the land by the owner instantly works its revocation, and in no sense is it property descendible to heirs.

Jensen v. Hunter (Supreme Court of

California), 41 Pac. Rep., 14.

KAFFIR CORN.

BY J. W. GREGORY.

Those who have pinned their faith to the idea that the Great Plains country would be made habitable, have felt sure that time and investigation would reveal certain crops adapted to the conditions there prevailing. Already the success of alfalfa growing in the valleys and, under irrigation, on the uplands, has gone a long way towards solving the problem of utilizing for homes these vast stretches of most fertile soil. Hard wheat, too, has demonstrated its profitableness to the persistent sower, and sorghum will be a factor of no small value; but it is doubtful whether any other single crop, thus far tested, approaches Kaffir corn in real value as an all-around, every year reliable standby for the great semi-arid areas of the country.

Kaffir corn, like all the seed-head bearing, drought-resisting grain and fodder crops, is of African origin. Its seed is borne at the top of the stalk like the seed of the sorghums, but in an erect, long and compact head. The leaves are very abundant and long, and hold on well. grain matures before the fodder and may be cut off before the fodder is harvesteda very decided advantage over Indian corn, which must be cut before the grain is ready for harvesting if the fodder is to be saved. The grain is not only equal as a feed for stock, pound for pound, to the best Indian corn, but has proven so palatable and wholesome for table use that several of the Kansas mills have provided special machinery for grinding it into flour or meal, and it is steadily growing in favor.

The yield of seed was as high as sixty bushels per acre, and will average about the same as Indian corn. In addition to the grain, a heavy growth of the finest fodder is produced, which is greatly relished by stock. Even the stubble, left from cutting in the ordinary manner, will be eaten down to the ground, and the largest stalks are eaten up clean. Horses, cattle and sheep will eat it in preference to the best hay, when tested as to choice.

Few general field crops will better repay thorough tillage and the applica-

tion of plenty of water and, on the other hand, no other crop yet tested will better withstand drought and neglect. If moisture is abundant, Kaffir corn thrives and attends strictly to business. If the water supply gives out and brassy skies and warm winds dry up and blow away Indian corn and crops of similar habits. Kaffir corn simply takes a rest and waits patiently for the next shower.

In general terms, it may be briefly stated that the preparation of the ground, the methods and times of planting and cultivation may be the same as with Indian corn. It is sensitive to frost, but not more so than is its Indian cousin. To make sure of a good full crop, a full average season of continued growth is required. If planting is too late, or cultideficient, or moisture lacking, vation or early fall frosts intervene, there will be more or less of a yield of roughness and more or less grain; but to be sure of a full crop, the seed should be planted as early as Indian corn would be and in ground as carefully prepared, and cultivation and moisture will be as well repaid.

There are two varieties, the red and the The red sort has proven greatly superior to the other as a yielder, making itself in about two weeks shorter time, producing a larger average yield of seed, a heavier growth of leaves to the stalk and having a much greater tendency to lift its seed-heads clear off the "boot" or sheath. A large proportion of the heads of the white Kaffir will have a zone of mildewed grains at the base, because of not coming clear of the sheath.

In planting, the seed should not, perhaps, be covered quite so deeply as Indian corn, but the rows should be about the same distance apart and the number of plants to the row or hill should be substantially the same as with the great staple. It may be check-rowed, drilled, listed or sown with results similar to those secured with the Indian corn.

The grain is sometimes harvested with a header and the stalks cut later; but there is danger of the heads heating and spoiling the grain if piled or binned in large masses before becoming thoroughly

dry. The best method of handling is to cut the whole crop close to the ground and after curing in the shock, run heads, stalks and all through a separator having a large proportion of the cylinder and concave teeth removed. This threshes out and separates the grain and puts the roughness in first-class shape for feeding.

If the seed is to be kept pure, the greatest care should be taken to prevent its mixing with sorghum, rice corn, broom corn, etc., which it will do unless kept out

at a broad distance.

IRRIGATION IN NEW ENGLAND.

THE Connecticut Pomological Society recently held a well-attended institute at Milford, at the invitation of the

Indian River Grange.

"Irrigation in Fruit Culture" was discussed by Mr. J. C. Eddy, of Simsbury, in a practical paper telling of his success in irrigating strawberries the past season. A portion of the field was unirrigated and the results showed a difference of over \$400 dollars per acre in favor of the watered portions. Mr. Eddy said that irrigation can be accomplished on most New England farms by simply directing the many hillside streams that are now running to waste. The successful growth of small fruits demands water at just the Profitable irrigating means right time. supplying an amount of water equal to one inch of rainfall per week. On Mr. Eddy's farm a large hydraulic ram is in use, as the fields are higher than the stream from which the supply is taken.

After the water is raised it is distributed through iron pipes, and at convenient points hose is coupled on and the water thoroughly distributed over the surface of the ground by means of a sprinkling nozzle. Mr Eddy is satisfied with the experiment, which paid its cost the first

season.

E. C. Vance, of North Haven, a fruitgrower of long experience, followed with a short paper, giving his methods of getting around a drought by supplying water to berry crops. He makes use of a stream, raising the water with a Rife ram. He is a firm believer in the value of irrigation.

A general discussion of the subject brought out many good points, among others that the leaf-blight on strawberries is diminished where irrigation is practiced.

Chairman Hale, in telling of the work of irrigation now being done on his fruit farm, said that the near future would see the many streams of water on the farms all harnessed to do the work of irrigation. He cited an instance when a timely shower had made a difference of \$200 per acre in a crop of peaches. But we must not depend on timely showers, but must have the necessary supply of water at hand at all times.

"What is true of the great advantages of an unlimited water supply in fruit growing is also true in respect to grass and other farm crops," said Secretary Gold of the Board of Agriculture.

Mr. Hale said that where the cost of an irrigating plant is a stumbling block, cooperation is the key to the situation.

MICHIGAN EMBRACES IT.

WHEN the subject of irrigation was broached at the recent meeting of the Michigan Horticultural Society, the fact came out that, during the past season, at the Michigan Agricultural College, water was used on small fruits and a variety of garden vegetables. Despite the dry season two waterings carried the strawberries, raspberries, blackberries, currants and gooseberries through their fruiting seasons with little, if any, loss of crop from the dry weather. The gain from the use of water in the case of the vegetables was from three to six fold in bulk, but as the quality was much superior where they were irrigated, the gain in the money value of the crop was even more than this. The water was carried along the ends of the rows in small wooden troughs provided with gates at intervals of three feet along the sides, through which the water could be drawn as desired. Shallow furrows were used to distribute the water along the rows, and as good results were obtained in this way as where tiles, either at the surface or buried a foot or more in the ground, were used. As soon as the water soaked in, the ground was cultivated to keep the moisture from evaporation.

M. E. Williams, of Douglas, Michigan, then told of the results obtained the last

two years in his peach orchard. The water was pumped from a river by means of a steam pump, 400 gallons per minute being distributed. Mr. Williams obtained a marked gain in the growth of his peach trees from the use of water, while the strawberries, corn and potatoes grown between the rows were greatly benefited. He is well pleased with the result.

S. D. Willard, of Geneva, New York, spoke upon the past, present and future of fruit growing, claiming that horticulture had decided advantages over agriculture proper, and that this is likely to remain so for many years to come. He advised careful study of the merits of different varieties, thorough cultivation, spraying and

manuring.

MINNESOTA CONVERTED.

DURING the recent meeting of the Minnesota State Horticultural Society, the great advantages of irrigation were acknowledged and advocated. In the Minnesota Horticulturist published by the Horticultural Society, appears the following, taken from the Minnesota Weather

and Crop Review:

"Tile draining, subsoil plowing and irrigation are three conditions of good farming that the tillers of the soil in this State must learn to appreciate. The benefits of their adoption have been so universal that the intelligent cultivator must acquaint himself with them. When he has done so, he will not be slow to adopt them. subject of irrigation is an old one, dating back 2,000 B. C. It is also a large one; whole volumes having been written on it. The simple fact is that seventy to ninetyfive per cent of a growing plant is water, and that the solid portion of it can enter into it only in a soluble state. Hence, the first great need of all vegetation is water, the second is water and the third is more water. If this is not supplied naturally, it must be artificially. Nature has done her part well in Minnesota in that about seventy per cent of the total rainfall comes when most needed, during the growing season from April to September. The average precipitation during that time is twenty inches, fully seventy-five per cent, or fifteen inches, of which runs off and is evaporated, leaving only five inches available for plant life. You will see that this

amount is entirely too little, as twelve inches are required to carry a full crop from germination to maturity. As some practical results of irrigation, the writer has seen five crops of alfalfa "under the ditch" cut in one season, averaging two tons to a cutting; thirty-five bushels of wheat per acre from soil that had but one thorough wetting and no fertilizer; while in England sixty-five bushels per acre is a common yield from irrigated soil.

"Admitting the need of an artificial supply, the question arises, How large a stream will answer a given purpose? A stream one inch square flowing at the rate of four miles an hour will cover an acre one inch deep in twenty-four hours. Ex-

pressed in gallons, it is 27,245."

YIELDS OF CORN AND KAFFIR CORN COMPARED.

F. D. Coburn, Secretary Kansas Department of Agriculture, says: As the sorghums, and more especially the non-saccharine sorts, are attracting wide attention now the fact that Kansas is having a larger experience with them than any other State (232,498 acres in 1895, and likely to be doubled in 1896), brings innumerable requests from all points of the compass for information as to their characteristics, growth, uses and values compared with those of other crops raised for similar purposes.

The foremost of these sorghums in popular esteem appear to be the red and white Kaffir corn. For seven years, beginning with 1889, the Kansas Experiment Station, at Manhattan, has grown Indian corn and red Kaffir corn side by side for the purpose of testing their comparative yields of both fodder and grain. The following table, compiled by Mr. F. C. Burtis of the station, who has had an oversight of the work, shows an annual yield of each:

RED KAFFIR CORN,			CORN.	
Year.	Grain per acre. Bushels.	Stover per acre. Tons.	Grain per acre. Bushels,	Stover per acre. Tons.
1889	71.00	9.00	56.00	2.50
1890 1891	19.00 98.00	$\frac{4.20}{6.00}$	$\frac{22.00}{74.00}$	2.50 2.95
1892 1893	50.00 49.00	5.00	30.00	4.55
1894	00.00	$\frac{5.25}{2.00}$	30.00	1.75 1.00
1895	43.07	1.53	22.76	1.64
Averages,* * Avera	55.01 ge of six	4.71 years.	x39.12	2.41

By this it is seen that the yield of Kaffir corn was very much larger than that of corn in five out of the six years, and the same as to the Kaffir corn forage every year. In fact the Kaffir corn yielded about 41 per cent more grain and nearly 95 per cent more fodder than the corn. The poor showing for both varieties in 1890 was due to a destructive frost September 12. the failure of grain in both varieties was due to there being no appreciable rain from the middle of July to September 1, and the fact that the crops side by side on alternate plats were in a poor upland prairie soil underlaid with hardpan. Yet, under these adverse circumstances, the Kaffir corn yielded double the quantity of fodder that was obtained from the corn. As Mr. Burtis says, "Such dry weather kills the corn and it must then be cut, but the sorghums live on; although the growth may be checked the crop matures."

Mr. Burtis presents the further conclusions from his experience up to the present time: "For the combined purpose of raising the largest yield of grain and a fair quantity of stover, it is a fact beyond doubt that the red and white Kaffir corns are superior to any of the non-saccharine sorghums and the sugar (sorghum) canes. The latter will produce more hay or fodder, and of a little more palatable quality, than the Kaffir corns, and are preferred by many on account of this fact when hav or fodder is the sole object. Although there is a great deal said about which is the best, the red or the white, I believe when the proper comparison is made, the conclusion will show but very little difference, at least not as much as was first supposed. Aside from the color, there is a much greater difference between the different strains of the same variety than there is between the red and white varieties. few who have kept their seed pure and carefully selected can testify to this when they have been, for some reason, forced to buy seed outside and got hold of some poor stuff. These sorghums are very susceptible to cross fertilization and modification, and there will be a rapid improvement or deterioration, according to the care that is exercised in selection of seed. Much of the Kaffir corn seed that is offered for sale is not the best. One may get as much difference in results from Kaffir

corn seed procured from two sources as between a very good variety of corn and a poor one."

IRRIGATING GRAIN.

In irrigating grain experiment has shown that by proper care in the application of a sufficiency of water prior to the planting of the seed, enough moisture can be deposited in the soil to mature a crop in any ordinary season, supplemented as it is certain to be by more or less rainfall at intervals. Thus, while twelve inches of rain are considered the minimum sufficient to produce a normal crop, and fifteen inches are better, yet with thorough saturation beforehand, and a subsequent precipitation of no more than six to ten inches, an abundant yield may be relied upon.

In preparing land for economically irrigating wheat or other grain, the land must be so situated that it has a slight slope and water from a given source conducted over all portions of it at a moderate outlay. Suppose that the field to be irrigated be supplied from the northern side and that it has a slope both to the south and east.

From the ditch on the north plow shallow furrows running toward the south, at distances which must be determined entirely by the nature of the soil. There are soils where water will seep from fifty to two hundred feet and there are others where streams are required every fifteen to twenty feet. After plowing the leading furrows at right angles to the main ditch, plow another set parallel to it and at the same distance from each other as the first ones. This will have the effect of cutting up the field into a number of small squares. The furrows should be shallow.

Now turn the water into them and let it run, not in a flood, but in a steady flowing stream, filling all the furrows gradually, and overflowing over the soil into the next series. Let the water run a day or perhaps two days, depending entirely upon the nature of the soil. But keep it running steadily until the soil is softened to a depth of two feet or more and it is impossible to walk about without miring. Then shut off the water, let the saturated soil dry until it will hold up a team (this may take one or two days) and then begin plowing. Set the plows so that they will go in beam deep and do not be afraid of

stirring up the soil as deep as you can. If you desire you can go over the field and cross plow. When this has been done plant the wheat or other grain and you may depend upon it you will reap a goodly harvest with the assistance of even the minimum rainfall which is certain to come. His best suggestion was to take the well ones away from the sick ones, when the first symptoms appear. Place them at least sixty rods away, change the location often, use aconite to reduce fever; sprinkle the pen with carbolic acid; clean pen and burn bedding daily.

POINTS ON DITCH BUILDING.

N laying out your system of ditches use care and time.

See to it that the water can get off your land as well as on to it.

Run your ditch lines on the high parts of your farm as far as possible.

Make the grade as light as possible and

avoid "silting up" or setting.

About four feet to the mile is what ordinary soils will stand.

It is better to have to clean the silt out of your ditches than to have them cutting away the sides or bottoms.

Cutting might be called "perpetual motion." If once begun it seems never to stop and the ditch gets lower and lower until you cannot get the water out of it.

A ditch should always be much larger

than is apparently necessary.

When the ditch is completed let very little water in for the first few days and shut it off every afternoon. Watch it closely, for even with the greatest care in construction you will find that the ways of water in a new ditch "passeth all understanding."

Build the ditches broad and the banks broad and the cows can wander across the ditch without miring in its banks and starting out a little stream of water which in a few hours will cut away bank and ditch and perhaps wash a deep gash across the upper half of your field and bury an acre of wheat in the lower half.

No Cure as yet.—The Illinois Live Stock Association met at Springfield, during the session of the Illinois Farmers' Institute. A. J. Lovejoy, of Roscoe, member of the State Board of Agriculture and president of the Winnebago County Institute, read a paper on "Our Hog Interests." He claimed that the hog is the most important of allfarm products, and gave many interesting figures. Regarding hog cholera, he said that as yet there is no cure for it.

Fortunes in Cornstalks.-The possibility of making good syrup from corncobs has been established. Still another discovery is made. The Foos Manufacturing Company of Springfield, Ohio, has just completed special machinery to be used in the manufacture of cellulose from the pith of cornstalks. The product is the invention of Mark W. Marsden, of Philadelphia, and is to be used in the construction of United States men-of-war to prevent the inflow of water after the piercing of unarmored portions of vessels near the water line. Mr. Marsden states that a company with \$1,000,000 capital has been organized at Philadelphia to manufacture the product, and that a large factory is now in course of erection at Owensboro, Ky.

Cranberries.-There is no one more interested in the subject of irrigation than those who raise, or rather are trying to raise cranberries. For the past ten years it has been uphill work. Fire has destroyed most of our vines, and in many instances the land also. Last fall I put down three wells, and erected three windmills, which are doing good work, and it is my intention to keep them running all winter. It is too early to tell what the result will be, but it looks promising. greatest trouble is in confining the water. During the winter and until about the first of June it is absolutely necessary to keep the vines under water. I have my ground surrounded with a strong embankment, but the water seeps through in spite of me. The soil is peat and sand. Ordinarily the water is about to the surface, but latterly it is anywhere from four to six feet below. When I put down my wells in October and November, 1895, I first sank a curb, made of two-inch plank, down to water, then put down a six-inch pipe to rock, about fourteen feet, and drilled into that some fifty feet. To the top of the pipe I attached an eight-inchiron cylinder

with a twelve-inch stroke; I believe my wells are inexhaustible by windmill power. Underlying the surface about four feet is a bed of solid heavy clay, from eight inches to one foot thick. Can you make any suggestions in The Age as to a cheap way of preventing the great loss of water? Arthur C. Mills, of Wisconsin.

[Have any of our readers had any experience in growin cranberries? If so we would be pleased to hear from them.]

The Apple Worm.—The following is a brief life history of the apple-worm moth: There are two or more broods in California in a season. The moth in spring lays her eggs on the young apples, pears, and quinces after the blossoms fall. The egg hatches out a tiny worm which feeds at first off the skins of the young fruit and usually soon finds the eye or calyx of the fruit, and then burrows its way by eating directly to the core of the apple, where it feeds on the forming seeds and surroundings. In about thirty-three days it is mature and burrows a channel to the surface of the fruit, usually at the side, when it crawls down to the larger branches or trunk, seeking some shelter where it can hide and spin its cocoon, which is usually done in acute forks, or in cracks, or under loose scales of bark. Inside of the cocoon it changes in three days to chrysalis and then in eight to fifteen days comes out as a moth and is soon ready to deposit its eggs for a new brood of worms. No spray has been found of any use in destroying the apple worm except the arsenical poisons such as Paris green and London purple.

Refrigerators being far from satisfactory, the custom is growing of having an ice house and cold room combined, especially for fruit and dairy purposes. The Country Gentleman gives an illustrated description of one that has proven satisfactory in which the cold room is on a level with the cellar floor and the ice chamber with the kitchen floor.

No sawdust or other packing used on the ice which wastes about one-half during the season, keeping the cold room about 35° and preserves fruit perfectly from season to season. The drainage of ice is carried by V-shaped iron troughs between the

joists to one point. Ice does not rest directly on joists but on a bed of lath. Doors are fitted with rubber to close perfectly tight, and both should never be open at the same time.

Feeding Sorghum.—It is true economy to feed sorghum and broom-corn seeds where they are grown. The following table gives the digestible nutriments of different grains:

Protein.	Carbo-hydrates.	Fats.
Sorghum Seed6.84	53.00	2.99
Broom corn7.10	56.80	3.00
Wheat9.50	60.90	1.90
Indian Corn6.25	60.06	3.14
Oats8.46	46.11	3.94
Rye8.37	63.16	1.09
Barley 9.64	00.77	1.86

Showing that the two former are richer in protein, or flesh forming material, than corn, and less carbo-hydrates and fats; indicating that for growing stock they are at least equal to corn but not equal to wheat, barley and oats. The grains being small and hard, they should be ground.

Oats.-Results of seven years' experiments with oats at the Illinois Station show that it is not advisable to plow after corn, the disc harrow causing better returns. Sow early and if broadcast two and a half to three and a half bushels per acre, covering no more than one to two inches. No one variety is greatly superior to all others. Neither color, plumpness, weight nor form of head certainly determine value, but generally varieties with long, slender, comparatively light kernels, have the smaller per cent of husk and probably greater feed value. Early varieties, harvesting before fully ripe, binding and shocking at once if in fit condition for cutting, are found to be preferable.

Salt is very beneficial to poultry; laying hens require it, as it has the properties of increasing the circulation of the juices of the body, thus favoring a greater protein assimilation. One ounce of fine salt daily to 100 hens, in shallow box that they shall not get too much.

Prof. C. C. Georgeson of Kansas Agricultural College, says recent experiments show that the disc harrow greatly improves failing pastures of natural grasses and

causes them to surpass in vigor of growth and tenacity of life any of the tame grasses that might have been substituted. "Southern Planter" says from an economic point of view there is no comparison between dry and silo feeding, and supports it with much evidence.

In spraying grape vines it is absolutely necessary that the right kind of spraying arrangement should be employed. A sprayer to be effective requires first of all a good strong force pump, next in importance is a nozzle that will throw a mist-like spray and will not clog when thick fluids are used. There are plenty of machines on the market filling all of these requirements.

In Egypt at least 50,000 pumps and water wheels are in use. The power used for propelling these consists of wind and oxen. About 200,000 oxen are used in pumping water from wells that are shallow and dug after a crude manner. The water thus secured is used for irrigating crops of rice and cotton.

In the United States the average cost of raising water 100 feet by steam pumping, calculated from the reports of twenty-four cities, is \$3.55 per acre foot. Where the height to which water is to be raised is less, windmills and pumps can be employed at a comparatively trifling expense.

A half-acre fruit and vegetable garden, well cared for, is worth from \$100 to \$200 to any intelligent farmer's family. Give the boys and girls a chance to show what they can do as market gardeners.

The Farmers Alliance and Industrial Union of Colorado accuse Senator John Sherman and Daniel Voorhees of conspiracy and treason against the nation and the people they were elected to serve.

The soil must be fertilized and kept in good condition if the farmer expects it to yield abundantly. Crop rotation is one method of soil conservation, and it cannot afford to be overlooked.

Beet, radish, onion or other small garden seed should not be planted more than a quarter of an inch deep as a rule. Sweet corn should be covered to a depth of five inches.

American hens can produce as many eggs and as cheaply as any foreign hen.

An abundance of water for irrigation, and a warm dry climate, as nearly free from frost and fog as possible, is of more importance than soil in growing oranges.

Beans are a profitable crop, and there is always a sure market, as ship loads are imported into the United States every year from foreign countries.

Good roads are an absolute necessity. Why not introduce new systems and improved road-making machinery? The West needs better roads.

Don't neglect spraying the fruit trees for codlin moth, and also to prevent the birds from destroying the buds and blossoms.

The size and quality of a crop do not always determine its value. Transportation and market facilities must be considered.

Practical experience proves that a light wooden silo holds ensilage in its place well and robs it neither of heat nor moisture.

Every farmer should have enough pride in his farm and its surroundings to keep everything in a neat condition.

Planting time has arrived, and the ditches should now be cleaned and put in shape for irrigation.

Young turkey hens will lay early, provided they were early enough last year to get a good growth.

Farming is impossible without good working horses, no matter what the electrical experts may say.

Hogs when first up for fattening should have the amount of feed increased slowly and gradually.

Plant your prune trees about twenty feet apart. They will not thrive as well if planted close.

The value of oats, as well as the yield, will depend upon the preparation of the soil.

It is not the soil but the sunlight that makes a sweet grape and a perfect fruit.

The barley crop is a good spring grain with which to sow grass seed.

If you want pea straw, seed thick; if you want a crop of peas, seed thin.

Burn smutty corn at once.

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Wheat does seem to have a "future" after all.

A FINAL survey of the Pecos valley railroad is being made.

THE millers, the dressed meats interest and various manufacturing interests urge Congress to restore the reciprocity treaties.

A RAILROAD is to be built from Colorado Springs to Cripple Creek which will place the great gold region within five hours of Denver.

THE National Pump Co. of Kansas City, Missouri, has been reorganized with a capital stock of \$50,000, to manufacture the Wonder pump.

As irrigating pump with a capacity of 7,200,000 gallons every twenty-four hours is being built by the Pueblo Foundry and Machine Works. It will be the largest pump in Colorado and will weigh about 100 tons.

A Congressional committee is to investigate the immigration question at Castle Garden, New York, and we predict that as usual it will do nothing whatever to stop the flood of foreign paupers who are driving out honest American workmen.

The latest official statement of the visible supply of grain is as follows: Wheat, 67,998,000 bushels, decrease, 947,000 bushels; corn, 7,647,000, increase, 1,493,000; oats, 6,615,000, increase, 246,000; rye, 1,554,000, increase, 22,000; barley, 3,246,000, decrease, 305,000 bushels.

THE memorials of the Chicago Live Stock Exchange and the National Live Stock Exchange, calling the attention of Congress to the discrimination made by foreign governments against the meat products of this country, and asking legislation relative thereto, have been presented and referred.

A BILL has been introduced in Congress constituting Andrew Carnegie, George A.

Kelly, Charles W. Batchelor, C. L. Magee, and twenty-six other persons a corporation, under the name of the Lake Erie and Ohio River Ship Canal Company, with power to construct and maintain a canal connecting Lake Erie and the Ohio river.

It is significant that President Baker's address, outlining the policy of the Chicago Board of Trade, contained no allusion whatever to option trading. The Elevator Combine and the bucket shops will be fought. President Baker is perhaps waiting to see what Congress will do about an anti-option bill. Many members of the Board are in favor of abolishing the gambling feature.

The Crippen Lawrence Investment Company, of Denver, has been taken out of the hands of the assignee and reorganized. The Denver Land and Water Storage Company is also going to be reorganized. Austin G. Gorham, the receiver, is well pleased with the outlook. The company owns 17,000 acres lying southeast of Denver. The water for the land is stored in the famous Castlewood dam. These instances would seem to indicate better prospects for the various land, investment and irrigation companies that have been struggling along the past two or three years.

A BILL has been reported in the U.S. Congress for the appointment of a nonpartisan commission to collect information and to consider and recommend legislation intended for the best interests of labor, agriculture and capital. The report which accompanies the bill states that in six years there has been a loss of \$34,-000,000 to employers of labor owing to disturbed and unsettled conditions, and that this is but a fractional part of the real loss sustained by employers and employed and others whose interests are affected indirectly. The better labor is protected in all its rights, the better wil be the security for earnings.

MINES AND MINING OUTPUT

Denver has five mining exchanges; population, 164,000; altitude, 5,280 feet; area of city, forty-four and one-half square miles; 5,000 acres in parks; manufacturers' output, 1895, \$50,000,000; gold output, \$17,000,000; silver output, \$12,500,000; total mineral output, \$33,324,358.12; live-stock receipts, 402,148 head; death rate, 11.04 per 1,000; sun shines 315 days in the year.

As an exchange says, many wildcat mining companies are making a still hunt in the east, taking good care that there prospectuses and other advertising matter shall not be seen at home where their false pretenses would be speedily exposed. Eastern investors will do well to ascertain the home standing of a company before putting their money in it.

Denver's fourth mining stock exchange will be known as the Denver Stock & Mining Exchange, and has a membership of 400, with the following officers: Thomas B. Stuart, president; J. R. Pratt and W. D. Wright, vice-presidents; John McMillan, secretary; and R. Mercy Anderson, treasurer. A fifth exchange has been organized recently.

The following is the world's output, of gold for the years named:

	July Journal Hearing	
1853.		\$155,000,000
1874.		90,000,000
		95,000,000
		106,000,000
		113,000,000
		155,000,000
		179,000,000
1895.		203,000,000

The Reform Press Association of Illinois has opened the columns of the papers controlled by its members to the silver party. In the resolutions adopted they state that they look upon the silver party as a friend and ally in the impending struggle between the masses and the classes.

J. J. Morr, chairman of the national committee of the silver party, has issued an address to the people arraigning the old parties for their financial attitude, and calling on Americans who are patriotic to join in a concerted movement for the free coinage of silver.

THE Paris Economist says the stock of gold in European state banks has increased \$622,500,000 since 1890. At the end of 1895, the banks of France and Russia possessed gold representing half the stock of all the banks of Europe.

Cy. Warman contributes to the Review of Reviews for February a very readable article on "The Story of Cripple Creek," illustrated by views of the camp and portraits of Messrs. D. H. Moffat and W. S. Stratton.

The output of the DeLamar mine, in Idaho, for the year 1895, is stated at 43,680 tons of ore. Total receipts, \$935,899.57; expenses incurred, \$469,807.85; net profits, \$466,091.72.

THE Farmers' Institute of Camden County, New Jersey, was practically unanimous in declaring for free coinage, and sent a petition to Senator Teller to be presented to the Senate.

A project is on foot to construct a reservoir in Platte Cañon, Colorado, and use the water power to generate electricity which will operate an electric railway from Denver to Cripple Creek.

UTAH kept her reputation good as a silver and gold producing region during 1895, and toward the close of the year several very rich new strikes of gold were made.

The gold production of two great States is compared like this:

 California
 \$12,538,780
 \$18,93.
 \$18,95.

 Colorado
 7,487,071
 10,618,463
 \$18,605,000

THE Beaver Hill Coal Company in Oregon are turning out 15,000 tons a month. The Colorado smelter, at Pueblo, is contemplating a change in the power plant.

The DeLamar mines in Nevada have a capacity of sixty-five tons daily. Some new machinery, recently purchased, will increase the output to 200 tons.

The creation of so many exchanges has opened the way for excessive speculation in stocks. The actual investor must be exceedingly cautious.

GEORGETOWN, Colo., produced 3,009 ounces of gold; 1,030,795 ounces of silver; 305,727 pounds of lead, and 3,315 pounds of copper in 1895.

THE Northwest Mining Association met in Spokane during February. Every mining town in the Northwest was represented.

GOLD-BEARING rock has been found on a mesa about four miles east of Las Vegas, New Mexico, but so far the assays have been low.

The President has signed the bill opening the government lands in West Creek district, Colorado, for mineral development.

CLARENCE King and party of Chicago capitalists, who own the Old Dominion mine in Washington, are inspecting it.

ORE receipts at Deadwood, So. Dakota, average 400 tons daily, with an average value of \$8,000 or \$240,000 a month.

THE "Great Falls Stucco Company" has been organized to bring out the gypsum deposits at Kibbey, Montana.

THE Ochoco Gold Mining Company of Chicago has been incorporated at Springfield, to mine gold in Oregon.

THE Governor of Arizona claims that State produced \$10,000,000 in gold in 1895 against \$4,000,000 in 1894.

The Big Cottonwood Power Company of Salt Lake City is putting in a 2,100 horse power electric plant.

Texas has not less than 20,000,000 acres of mineral land. The most abundant metallic product is copper.

THE projectors of the proposed smelter to be built at Galena, Kansas, have incorporated their company.

WATER ELEVATORS are becoming very popular in Nebraska, New Mexico and other Western States.

SAND on the sea beaches of Oregon contains gold, and wonderful stories are told of their richness.

THE total dividends paid by the Ontario Silver Mining Company of Utah amount to \$13,190,000.

About fifteen or twenty mining companies are being organized every day in Colorado.

THE Cedar Vale (Kansas) Mining Company are mining for gold near Orlando, Oklahoma.

It is predicted that before midsummer Cripple Creek will have a population of 75,000.

A DISCOVERY of opals has been made on a tributary of the Big Camas Creek in Idaho.

THERE is more activity in lead and zinc mining at Galena, Kansas, than ever before.

THE People's Party of Massachusetts has declared for silver coinage at sixteen to one.

THE assay office at Boise, Idaho, recently shipped \$32,257.32 in gold in one day.

CINNABAR was lately found in paying quantities near Great Falls, Montana.

QUICKSILVER has been discovered a few miles from Snohomish, Washington.

THE great smelter at Spokane, Washington is to start up immediately.

An organized movement is on foot to develop Montana's iron mines.

CRIPPLE CREEK still continues to be the principal feature in Colorado Mining.

New Mexico is beginning to feel the effects of the mining activity.

THE pay roll for labor alone at the Butte camp is \$800,000 per month.

THE big shaft of the Anchoria-Leland mine is being sunk rapidly.

New rich strikes are being reported almost daily from Colorado.

THE rush to the mining fields of Alaska is just beginning.

A NEW chlorination mill is proposed for Cripple Creek.

St. Louis and Boston also list Colorado mining stocks.

MINE-SALTING is not so successful as it used to be.

Parties from Alaska tell of a gold-bottomed lake.

Iron Mines are being opened at Jefferson, Texas.

COAL is being mined at Enterprise, I. T. BUTTE has no mining exchange.

THE PROGRESS OF WESTERN AMERICA

IRRIGATION FROM THE GREAT LAKES.

NE cause of anxiety concerning the lake levels is the immense "Drainage Canal" from Lake Michigan, at Chicago, through a portion of the State of Illinois. But the "Drainage Canal," with its great drainage on Lake Michigan, is really a merchant-ship canal which provides another water route to and from the Atlantic, this time via the Mississippi river, and it cannot be interfered with. By this route, American men-of-war can come up to the lakes. Congress will look after the lake levels and, by a system of immense dams in different locations, the level of the lakes will be kept sufficiently high so that the stage of water at the shallowest points in connecting rivers (with additional dredging and rock blasting) will be deep enough for the largest and deepest lake carriers. This ship canal is really a National institution, and in case of war would be all-important, as it will at all times be to the commercial world. There is a secret about this great project which may now be let out. For years old residents of Chicago labored for it, but, under the name of "a ship canal, to connect the lakes with the Mississippi and the Atlantic," the masses refused to expend the millions necessary. The matter was allowed to drop out of the public mind for a few years, and a seemingly brand new project of "a great drainage sewer for Chicago" was then broached, and it went through with a rush. Now Chicago has her drainage sewer and the nation has a great ship canal, and the dear people are benefited even against their own sweet

And if a ship canal, or a drainage canal, why not an irrigation canal? As the safe and sure (the irrigation) plan of farming grows in Illinois, it will suggest itself to the agricultural classes that this "Chicago Drainage Canal" can be tapped, and that other, special, irrigation canals can be

built, and so it will go until Illinois has a system of irrigating canals. And if this can be brought about in Illinois, then every State having a lake front can follow her

example.

Irrigation is being adopted generally in the central West, and in the Eastern and Southern States, and the people will go any length to obtain water. In a word, the agriculturists seem to have suddenly awakened to the fact that the element of uncertainty can surely be removed from their industry and that the means to this end is irrigation. Located on fertile soil, they are tired of losing a crop every other season, while farmers on arid lands in the far West have a certainty of several crops every season.

For the present the central Western States just resorting to irrigation—Illinois, Wisconsin, Indiana, Michigan, etc.—will confine their operations mostly to the orchards and the garden vegetables, and wells, pumps, and reservoirs will be the means of obtaining and accumulating water, but sooner or later the lake States will be watered from those great fresh water lakes, and there will be water enough obtainable to insure the safety of all the

LIVE STOCK INTERESTS.

great staple crops.

Samuel W. Allerton, one of the large pork packers of Chicago, is in Washington in the interest of live stock growers, shippers and traders. At a recent meeting of the representatives of the Live Stock Exchanges of Omaha, Kansas City, Sioux City, Buffalo and Pittsburg, it was determined to petition congress in regard to the re-establishment of reciprocal relations with foreign countries, so that cattle and hogs could be sold to advantage. Communications were addressed to the members of the Ways and Means Committee, and a hearing has been accorded the representives of the National Live Stock Exchange. We shall go before the subcommittee on reciprocity, of which Congressman Hopkins of Illinois is chairman, and state our case and urge prompt action

by Congress at this session.

Mr. Allerton said: "It is all well enough to talk about a restoration of the tariff, but no relief from such a source can be obtained inside of six months. On the other hand, if we can renew our former relations with Germany, Belgium, Switzerland and other European countries, so that our cattle may be sold there, the benefit will be instantaneous. This point will be impressed upon the Ways and Means Committee, and I do not see how this body can fail to act promptly upon a matter which is so vital to the interests of the United States."

Governor McIntire, of Colorado, has issued a proclamation establishing a quarantine against cattle and horses from California, Texas, and the territory of Oklahoma, and other States and Territories lying south of the thirty-sixth parallel of north latitude, and prohibiting their admission to the State except upon certificates of the Veterinary Sanitary Board or their duly authorized inspectors.

Governor Rickards, of Montana, has issued his proclamation prohibiting the importation of sheep into Montana from Oregon, Nevada, California, Washington, Wyoming, Idaho, Colorado, Utah and Territories of Oklahoma and New Mexico.

There were 14,000 head of cattle in the Kansas City yards about the middle of the month.

A co-operative creamery association has been organized at Darien, Wisconsin, that will erect one of the finest creameries in the State. The charter has been secured and officers elected as follows: L. E. Hastings, president; M. E. Cusack, manager; M. H. Gardner, secretary; B. J. Blakely, treasurer; Frank Randall, John Piper and Clarence Mereness, directors and building committee.

The Western Packers' Canned Goods Association of Chicago has elected L. G. Seager, president; J. S. Edwards, Leavenworth, Kansas, secretary and treasurer.

At the Indiana Congress of Industrial Associations, composed of the organizations engaged in the promotion of agricultural pursuits, Governor Matthews

urged the establishment of a midwinter stock show to be held in connection with the Chicago show.

The Kansas City Cattle Company has received a charter from the State of Kansas, and will engage in the cattle business on a large scale.

The Union Stock Yards, at Sioux Falls, So. Dakota, has incorporated with \$1,000,000 capital stock.

The South is at present affording a fair market for horses.

Commission men have taken up the fight for live stock shippers against the switching charge of \$2 per car levied on all' stock by the railroads in Chicago, and the case is before the Illinois Railroad and Warehouse Commission.

At the annual convention of the National League of Commission Merchants of the United States, in St. Louis, it was resolved that the commission men of the country were the representatives of the producers, and that they must see to it that producers get fair transportation rates and fair treatment as regards a saving of time in shipments and proper handling of the products. A firm stand against the railroads was decided upon.

GOOD ROADS.

Good Roads Parliament, at its last session, held at Atlanta, Georgia, heard reports from thirty-two States relative to the progress made in the construction of roads, and as to legislation concerning good roads. The United States government had constructed on the Exposition grounds four classes of roads, and the afternoons during the session were spent in seeing the roads tested. The members of the Parliament also witnessed the construction of an improved road by convict labor, engineering skill and improved machinery. There were exhibits of road material from all sections of the Union. The officers of the Parliament, as elected, are: President, Gen. Roy Stone. Washington, District of Columbia; first vice-president, Judge W. F. Eve, of Georgia; second vicepresident, Hon. J. A. C. Wright, of New York; secretary, W. G. Whidby, of Atlanta, Georgia; assistant secretary, J. S. Rogers, of New Jersey. The next meeting will be held at Nashville during the Tennessee Centennial Exposition.

Congress and the Legislatures are respectfully reminded that the farmers, the bicycle riders (embracing about half the population of the country) and the bicycle manufacturers (representing many millions of dollars) are a unit in demanding good roads in every State in the Union.

IRRIGATION REPORTS.

In the list of irrigation reports that appeared in the January issue of The Age, by an oversight two of the earlier ones were omitted. They are as follows:

Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare and Sacramento Valleys of the State of California, by Lieut.-Col. B. S. Alexander, Major G. H. Mendell, and Prof. George Davidson. Washington Government print, 1874, pp. 90 and maps. Only 500 copies printed and now scarce. And a report on the Irrigation and Reclamation of Land for Agricultural Purposes as now practiced in India, Egypt, Italy, etc., by Prof. George Davidson. Washington Government print, 1875, pp. 70 and maps. 500 copies printed and now scarce.

Mr. H. M. Wilson says, in his paper on American Irrigation Engineering, p. 138, of these two reports that "they are two of the mile-posts which mark the awakening of the people of California and the country at large to the subject of irrigation and the necessity of learning the best

methods of practicing it."

A LUMBER TRUST.

The lumber interests of the Pacific coast have consolidated. The Central Lumber Company of California, recently organized, controls \$70,000,000 of capital invested in lumber mills, timber lands, vessels and plants. It comprises practically all mill and ship owners and every wholesale and retail dealer on the Pacific coast. The price of lumber has been advanced \$2 a thousand feet already.

KANSAS.

The Valley State Bank of Hutchinson, Kansas, suspended February 11.

There are forty-five windmill irrigation plants around Larned, according to E. E. Frizell.

John Edwards, of Larned, says the great need of the Pawnee valley is a canning factory. Kansas lawyers are trying to have the State divided into two districts, each with a United States District Court.

W. B. Sutton of the Kansas State Board of Irrigation is very enthusiastic in regard to the reclamation of the great plains by means of pumps and windmills.

Prof. A. R. Taylor of the Kansas State Normal School is in Washington trying to get Congress to pass a bill appropriating part of the revenues of public lands to the support of all State normal schools in the United States. He is also trying to aid in securing the passage of the Fort Hayes bill, by which the State Normal School of Kansas will be much benefited.

The State Board of Irrigation of Kansas has practically determined to locate an irrigation plant at Hoxie and another at Wallace. These plants are a part of the seven remaining under the act of the Legislature to be located. Chairman D. M. Frost of the Board has been making some tests of the underflow near Garden City. By means of a pump, with a sixinch supply and four inch discharge pipe, he pumped 600 gallons of water per minute from the well. Experiments will be made by the Board for the purpose of discovering whether or not it is possible to exhaust the underflow in that well.

H. V. Hinckley, of Kansas, the well-known authority, presented an excellent paper at the recent session of the Kansas State Board of Agriculture upon the subject of "Underflow as Related to Irrigation Development." He said the residents of the plains are entirely correct in their view of the underflow—that it does flow—and insisted that too many canals have been built where reliable water supply is not a surface supply. Pumping plants and gravity developments of the underflow furnish reliable supplies which can be guaranteed in advance of the investment, whether a few thousand or millions of gallon a day.

The name of the Kansas Mutual Life Association has been changed. The organization will hereafter be known as the Kansas Mutual Life Insurance Company. This action was taken at a meeting of the Board of Directors in February. This institution has entered upon the fifteenth year of its business career. The present officers of the company are as follows: President, John P. Davis; vice-president, W. M. Welcome; secretary, John E. Moon;

assistant secretary, W. B. Kingsley; superintendent of agents, F. E. Marsh; medical director, Dr. S. E. Sheldon; actuary, C. G. Blakely; counsel, R. T. The Board of Directors is Herrick. as follows: E. N. Morrill, John R. Mulvane, W. M. Welcome, John P. Davis The members of the and John E. Moon. Advisory Board are as follows: T. B. Sweet, Jonathan Thomas, Edward Wilder, E. H. Snow, Geo. M. Noble, Thomas Page, Charles Wolff, H. E. Ball, P. I. Bonebrake, Samuel T. Howe, Willard N. Hall, Geo W. Crane, C. R. O'Donald, H. A. Heath, Joab Mulvane, James A. Troutman and Charles S. Gleed.

NEVADA-

In past years comparatively little interest has been taken in the irrigation question in Nevada as a factor in the upbuilding of the State, but recently, and as the people have grown to appreciate her agricultural possibilities, several large irrigation enterprises have been discussed, but as yet none of these have progressed beyond the initial stage, though one or two at least, promise to be carried out in the near future.

The most notable of these is a project to utilize the water of the Humboldt river, supplemented in the latter part of the season by stored water, to reclaim some 60,000 acres of fine alluvial lands on the north side of the river at Battle mountain. At this place storage can be accomplished and canals constructed so cheaply, that if the enterprise shall be carried out as at present planned, the land, with water delivered and water right free and perpetual, can be sold as low as \$10 per acre and still yield a profit of 100 per cent on the investment.

At Lovelakes, near the lower end of the Humboldt valley, about 1,500 acres of new land will be brought under irrigation and cropped this year. S. R. Young, of that place, is pushing work on his canal which is designed to supply water to some 4,000 or 5,000 acres of land not now under ditch, and hopes to have it completed before the end of the year.

In Carson valley, Mr. Newlands, representing the Sharon Estate, is prepared this year to supply water from his reservoir, constructed in 1895, to some 3,000 or 4,000 acres of new land.

From every county in the State come reports of developments, both agricultural and mineral, and of increase of population which, though not great, indicate that the period of decadence of the Sage Brush State is past, and that she is already entering upon a new era.

SO. DAKOTA.

At the meeting of the executive committee of the So. Dakota Immigration Association in Aberdeen, recently, it was decided to take up the matter of irrigation and immigration in an active manner. The committee represented all parts of the State.

The dates for the irrigation convention at Redfield, S. Dakota have been changed to March 4 and 5. The call was issued by State Engineer of Irrigation Baldwin.

R. M. Springer is organizing a company to irrigate South Dakota lands with artesian wells.

NEBRASKA.

The late irrigation convention, at Sidney, seems to have given a great impetus to irrigation in that vicinity. This same result has followed the holding of these conventions at other points in the State. Many district canals are now projected, and a number of the canals completed or nearly completed will be converted into district canals.

The great underground flume, near Sutherland, that carries the water of the North Platte across and under the South Platte river has so far proven a success.

The farmers of Nebraska are generally adopting the windmill system of irrigation, and windmill plants are now to be seen all over the State. At a late meeting of the State Horticultural Society, at Lincoln, the question of irrigation was discussed to a great length. I. A. Fort read a paper on Irrigation for the Orchard and Garden, stating what had been done in Nebraska on these lines.

The State Irrigation Immigration Society held its first meeting in the Capitol building in Lincoln, on the 14th of January, to perfect arrangements to promote immigration to the irrigable lands of the State.

North Platte will hold a Western Nebraska Fair at some time during the com-

ing summer. They propose to show what irrigation can do for the State. The fair will immediately follow after the Lexington Irrigation Convention. Hon. W. F. Cody's Wild West, will arrange to exhibit during the fair week, as the show will be en route to the Pacific coast at about that time, and the show will again exhibit in the town that gave it birth.

The farmers who are using farm mills for irrigation purposes are making complaints that they have not sufficient strength to stand the strain that comes from working the extra large and heavy pumps that are used for this purpose. Extra heavy strong mills, like the Aermotor, are needed.

The district canal promoters are waiting in suspense on the decision of the U.S. Supreme Court on the validity of the Wright Act.

WESTERN PUSH.

Seattle, Washington, is to have a new water supply, for which \$1,250,000 was voted in December.

It has been learned that the contract for building the big irrigation canal through Fort Hall reservation, in Idaho, is good, in spite of the protest made by the Indians.

"Indian" Jones, of Utah, has gone to Washington with a monster petition in favor of opening a portion of the Uintah Indian reservation.

A new industry is being developed in Orange County, California, that of manufacturing oil from eucalyptus leaves, which is being used extensively for medicinal purposes.

Prof. George Davidson, of California, has just finished an examination and report upon the nearly completed project of the Stanislaus and San Joaquin Irrigation Co., a project that proposes to irrigate some 200,000 acres of land in the neighborhood of Stockton in the San Joaquin valley. They take their water from the Stanislaus river above Knight's Ferry, and take it seventeen miles to the plains. They have put up some good flumes, one 2,400 feet long in two sections of 1,200 feet each, and ninety feet from the ground to the bottom of the flume box.

MINERAL WAX.

The true mineral wax was discovered thirty or forty years ago in Eastern Utah, on Howland mountain, in the Pleasant valley country, says the Mining Industry, and in other districts in Utah. It was the true ozocerite and was named utahcerite claytonia by and after Professor Clayton. of Salt Lake City. It corresponds to the paraffine that is obtained as a product of the petroleum refineries of Pennsylvania, and which is used in the manufacture of candles and for a variety of purposes. The native article has not yet been found in this country in quantities sufficient to make it pay. In the raw, some ten years ago, it was quoted worth \$800 per ton. The principal mines are in Galicia, Austria, where the deposits are large, and the mining of it is done by women and children. True ozocerite is a lustreless black and melts in the sun's rays. It is very light, burns at high temperature and is odorless. Nearly all the candles of the Greek Church in Russia are made of ozocerite, which is refined and bleached to nearly a transparent whiteness, and the candles are handpainted with flowers and religious symbols. As a by-product the ozocerite yields cosmetics, dyes, gas and a score of other articles, and if a prospector is ever lucky enough to strike a large deposit in Utah or Wyoming, he will have a good thing. For several decades of years the Galicia mines were supposed to be the only ozocerite mines in the world, but of comparative recent date a discovery was reported in Egypt and somewhere in South America. The Pleasant valley mines were developed, but the ozocerite at depth gave place to asphalt and minerals of kindred nature. The ozocerite is most likely to abound where salt beds and coal or petroleum are in contact.

An exchange from that State says: "The new dispensation for Western Nebraska is based largely upon the windmill. To be able to pull through from one year to another, through thick and thin, is the one thing desired for the pioneer. With water for but a few acres this consummation is reached."

FLOUR MILL.

A flour mill is needed in the Pecos valley. Strong inducements are held out to an enterprising miller.

THE EDITOR'S DRAWER

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Pueblo, Colorado, has a population of 38,000.

THERE is still money in high-class, thoroughly broken carriage horses.

THE fifth session of the National Irrigation Congress will be held in Phoenix, Arizona, early in December, 1896.

THE Pottawatomie tribe of Indians in Southwestern Michigan will have \$104,-000 distributed among the 240 surviving members.

THE new officers of the Indiana State Board of Agriculture are: President, W. W. Hamilton; vice-president, James E. McDonald; secretary, Charles F. Kennedy; treasurer, E. J. Robinson; executive committee, Aaron Jones, Charles Downing, V. K. Officer.

AFTER all, Max O'Rell is something of a When he said that the reason wise man. the sun never sets on the British Empire is because the great orb cannot trust an Englishman in the dark where there is any land he can possibly covet, he hit the nail on the head.

How to stop the adulteration of ex--tracted honey was one of the subjects vigorously discussed at the recent meeting of the Illinois State Bee-Keepers' Association, in Chicago, and it was decided to ask that a law be passed by the State Legislature and also by Congress.

Officers elected by the Illinois Grange Worthy Master, Oliver Wilson, were: Putman county; overseer, S. G. Atwood, Winnebago county; lecturer, Alexander Kedy, McLean county; chaplain, T. J. Crowder, McLean county; steward, J. W. Whitson, Schuyler county; assistant steward, J. E. Siler, Wabash county.

CHEAP newspapers continues to be the watchword. The New York World, probably the greatest newspaper on the continent, has just reduced its price to one cent a copy. In announcing this change it states that it is the intention to set up a standard as to how much a newspaper can give for one penny and not how much can be charged for a minimum amount of news and information.

A CALL has been issued for a meeting of the Farmers' Alliance and Industrial Union of Kansas, to be held in Topeka, on April 9, 10, and 11. The meeting is for the purpose of organizing a State Co-operative Congress, and representatives from every co-operative association in Kansas and elsewhere are invited to attend and discuss practical methods of co-operation. The call is signed by A. Wardall, president, and S. D. Cooley, secretary.

CHAIRMEN of standing committees in the Illinois Farmers' Institute are as follows: Agricultural Education, Prof. Eugene Davenport, Champaign; Agricultural Advancement, Col. J. W. Judy, Tallula; Education of Farmers' Children, S. M. Inglis, Springfield; Dairy Husbandry, John Stewart, Elburn; Horticulture, T. E. Goodrich, Cobden; Live Stock Breeding, J. M. Thompson, Joliet; Finance, F. M. Palmer, Clinton; Transportation, C. F. Mills, Springfield.

Among those present at the session of the Illinois State Bee-Keepers' Association, in Chicago, were: President C. C. Miller, Merino, Illinois; E. R. Root, Medina, Ohio; W. J. Finch, Jr., Springfield, Illinois; J. Roorda, Thayer, Indiana; M. M. Baldridge, St. Charles, Illinois; Mrs. N. L. Stowe, Evanston, Illinois; W. Blume, Edison Park, Illinois; George Thompson, Geneva, Illinois; Christian Schrier, Peotone, Illinois; A. N. Draper, Upper Alton, Illinois; W. C. Lyman, Downer's Grove, Illinois.

THE following officers of the National Reform Press Association were elected for the present year at the fifth annual convention held at Dallas, Texas, in February: President, Paul Vandervoort, of Nebraska; vice-president, Frank Burkett, of Mississippi; recording secretary, C. Rosell, of Missouri; corresponding secretary, J. A. Parker, of Kentucky. Executive Committee, J. H. Ferris, Illinois; Charles X. Matthews, Indiana; S. Peters, Texas; Abe Steinberger, Kansas; Miss Mary E. O'Neill, of Missouri, editor of Reform Kansas; Miss Mary Ready Printer; W. S. Morgan, of Arkansas.

TOPICS OF THE TIME

The Territories of New Mexico and Arizona have Southwest Repudiated. been denied admission to the Union as States. Not a straightforward, outright denial, but an equivocal putoff-do-nothing policy has been adopted. Can the United States Congress afford to Are these two continue on this line? great territories of the Southwest to be denied the privileges of statehood because the do-nothing policy politicians do not wish to have the West adequately represented for fear that the silver cause would be strengthened by the addition of four senators? The population of these territories is sufficiently large to meet the requirements, in fact it is larger than that of many of the States when admitted to the Union, and the people are of an energetic, enterprising character. The mineral wealth is practically unlimited, consisting of vast deposits of gold and silver and other ores. The agricultural interests, while yet in their infancy, have attained a sturdy growth and are being developed The Pecos valley, in Southeast New Mexico, is a notable instance of what can and has been accomplished in this di-The earnings from the live stock industry amount to millions of dollars annually. The natural resources and possibilities, the material wealth and the population are the claims which should justly entitle these Territories to a place in the Sisterhood of States. Will they be recognized?

The Mining activity of the West Mining has steadily increased during the Boom. winter, and present conditions would seem to indicate that the spring and summer will show an unusual amount of work in this line, in fact it is assuming the nature of a boom, and already the conservative men are beginning to deprecate anything tending to increase the excitement. The name of Cripple Creek has been the talisman that has charmed every body and drawn them toward it like a magnet. The rich strikes in this district have

led to active development work in every district in Colorado and the fever has spread throughout the Western States. In the February Review of Reviews, Carl Snyder predicts a flood of gold, basing his conclusions upon the greatly increased production of the yellow metal in the last few years. Even admitting that his estimates of the output in the years between 1896 and 1900 are correct, there is no danger of a glut of gold. The world has never had sufficient metal money with which to carry on legitimate business. But without enlarging upon this view of the matter there is a danger which must be faced and overcome or it will work untold harm, not only to mining, but to every other interest in the West. It is the tendency to BOOM. There have been too many booms. The best interests of every Western State demand a preservation of the confidence of the investor. A boom will attract only sharks and speculators. Actual development and a steady (if slow) growth will invite the confidence of men and money and result beneficially to every interest.

Its Effect There is another phase of the on Other mining question that has as Interests. yet been touched upon but little. It is the effect it will have upon the agricultural development. The miner must be fed, pork and beans are as necessary (if not more so) than gold ore a hundred to the ton. The great stream of men now pouring into the mining camps will consume hundreds of thousands of dollars' worth of the products of the farm and the factory. The farmers and fruit-growers, the cattle-raisers, the manufacturers and merchants can all prepare for more prosperous conditions and a better market. As for the railroads—it is said that one line running into Cripple Creek is clearing \$50,000 a month.

Now is the time for the land and irrigation companies to put forth their best efforts, providing they are dealing honestly with their patrons. Many inducements can be held out to the prospective settler who desires a home and a living for himself and family. On a few acres of irrigated land they are in no danger of starvation and there is no reason to complain of lack of market for the surplus product.

"In the City of Washington .1 Foreign only a very crude conception is actually entertained about the West and its resources, while in Austria I think we can tell you the population of Such was the expression of Baron Von Hengelmuller, the Australian ambassador, while on a western trip in What a commentary on the February. American people and their ways! Should we be obliged to wait for the representative of a foreign nation to come here and tell us that we know less about our own country than the inhabitants of Europe? Will the East ever get an accurate conception of the West? Will it ever fully realize that west of the Missouri river, omitting Alaska, lies a country, not only larger in extent than all of Europe, excluding Russia, but greater in natural resources than any other section of the globe? Will the Eastern Senators and representatives in Congress stop dickering about a postoffice in Podunkville and give a few

minutes of their valuable (?) time to the consideration of irrigation and western development, or will the members of Congress from the Western States drop partisanship and private enterprises for a while and become a unit in insisting that the recognition to which it is entitled be accorded the larger portion of the country?

Kansas, the irrepressible, is What Kansas again in the saddle. It does is Doing. not purpose to sit idly by and watch the tide of immigration flow into other sections without an effort to stop a portion of it in the valleys and on the prairies of the Sunflower State. Kansas Immigration and Information Association has been formed for the purpose of disseminating reliable information relative to the agricultural, commercial, manufacturing and mining interests of the State. W. C. Edwards, the Secretary of State, is the president and moving spirit, and Frank D. Taylor, secretary. In the hands of such efficient men the movement cannot fail to be a success, and it is being seconded by Gov. E. N. Morrill, Col. John E. Frost and many other leading men. Already public meetings have been held in Illinois and Indiana, and arrangements for others are being made.

COMICALITIES.

A BIRD that can't sing, and will sing, should be made into a pot-pie.

THE YOUNG man just out of school advertises for a "position," but after six months of hustling he is mighty glad to get a "job."

"This is the biggest jump on record—a Providence man has jumped the State." "Oh, pshaw! that's only Rhode Island! Now, if it had been Texas—."

HANK BITTERS.—How are you goin' to the masked ball tonight, Ike?

Alkali Ike.—Thought I'd keep sober

HANK BITTERS.—That's disguise enough, nobody'll know you!

Texas Jack.—I guess we'll have to run that tenderfoot bank cashier out of town!

Broncho Bill-What for?

Texas Jack.—You know the last feller we strung up for horse stealin'? Well, that cashier actually wanted the man identified first!

Mr. Isaacs (at the skating rink, excitedly).—S'hellup me Fadder Apraham! Dat poy vas neffer learnt nuttings. He neffer vill get de vort' of his moneys, any dimes.

Mrs. Isaacs.—Vat's der matter, Fadder?
Mr. Isaacs (in agony).—Vy, schoost look at him! I bays me feefty cents fer him to skate on der ice, and he goes apout on von foot most of der dimes.

Tenn de Foote.—I head they give a man plenty of chances in the West.

Col. Yellowstone.—Well, it depends on what he has done. Ordinarily he has a chance with the vigilantes, and a chance with the judge, and a chance with the jury—even after that he has a chance of the rope being shot in two before life is extinct.

"How did you like it in the West?"

"Not very well. It took too much attention to find out just when to throw up your hands and when to lay down your hands."—All from Puck.

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BUILDING CANALS CHEAPLY.

The New Era grader and ditcher, and its predecessor, the Wauchope, have been in use for nearly twenty-five years, and have always given satisfaction. The New Era is designed especially for building large irrigation canals, railroad embankments and levees. The chief points in its construction are as follows:

The plow is constructed to stand as great strain as any plow moved by horse power; and by draft chains, gauge wheel, guide arms and elevator chains, is easily

controlled by the operator.

The carrier is built in four sections and, by bolting together the various parts, will carry and deliver earth at fourteen, seventeen, nineteen or twenty-two feet from the plow, or if necessary can arrange for twenty-four-foot delivery, or at its extreme length, at a height of eight feet above the plow. The transverse carrying belt is of heavy three-ply rubber, three feet in width, and arranged so it can be readily and quickly changed in length. It is moved upon a system of rollers in the carrying frame by a drum at the outer end of the carrier, driven by a strong gearing attached to a heavy steel shaft, which constitutes at once the rear axle of the machine, as well as the propelling power of the carrier, by means of the broad rear wheels, which are ratcheted at each end.

The truss work is broad and low, covering eight feet in width by fourteen feet in length, exclusive of the long carrier.

This enables it to work on steep hillsides, where any wheeled implement can be used, and as the front wheels are low and turn under the truss work, the machine is very readily turned in much less time and space than required for a lumber wagon.

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necessary mechanical device essential to its many uses, it is yet so simple in its construction that any man of ordinary intelligence readily comprehends its management, and with brief experience can successfully operate it.

The working force necessary to operate the New Era is twelve horses and three men. Eight horses are used in front; four abreast, guided by one driver, and four are driven behind on a push cart and controlled by a second driver, while the third man, who usually acts as foreman, governs the working of the machine.

The cost of moving earth in great quantities by means of the New Era grader is

reduced to a minimum.

For smaller ditches and road making the Austin Steel Reversible machine will do the work rapidly and cheaply, and better than can be done with plows and

scrapers.

The F. C. Austin Manufacturing Company, of Chicago, who manufacture the New Era Grader and Reversible machine, also make rock crushers, street sweepers, sprinklers and rollers, contractors' plows, wheel and drag scrapers, tubular truss bridges and well-making machinery.

Catalogues, price lists, and special information will be sent upon application if THE IRRIGATION AGE is mentioned when writing. See advertisement on inside

back cover.

According to the United States census there were in June, 1890, upon farms, 8,097 artesian wells. Three thousand nine hundred and thirty wells were employed in irrigation, watering 51,896 acres, or an average of 13.21 acres per well. Over one-half of these wells were in California. The average depth of these wells was 210.41 feet and the average cost \$245.58. The number of wells and the acreage irrigated has been very largely increased since the taking of the census. This is especially true of South Dakota, where for the time being all other interests seem to be subordinated to irrigation by means of artesian wells.

ELECTRIC POWER PAPER MILLS.

The Cliff Paper Co., of Niagara Falls, are building a new power house, in which they will generate electricity for use in their paper mill. This paper company has a pulp mill, driven by two Leffel Wheels, of 2,500 horse power, at the water's edge below the falls, and a paper mill on the top of the high cliff, thus securing a double service from the water. This double use of water is quite an innovation, and has brought discredit upon the saying that "The mill will never grind with the water that is passed." Now, this progressive company is about to take another step to practice economy, and it will adopt electricity, to succeed steam, to run their paper machines. When this proposed electric plant is installed, it will drive out three steam engines of over 200 horse power. Preparatory to the adoption of the electric current, this company will build a stone power house, 20 by 30 feet in size, close to their pulp mill. The penstock leading to the pulp mill will be tapped, and a portion of the water diverted to run a 250 horse power James Leffel turbine, to which will be attached two 125 horse power generators. At the top of the cliff will be two electric motors, of 100 horse power each, attached to each of the paper machines; besides there will be two motors of five horse power each, to furnish power for the small machinery about the mill.

THE tenth annual State Farmers' Institute, with Superintendent George Mc-Kerrow, of Madison, in charge, will convene at the City of Watertown, Wisconsin, from March 10 to 13. A large number of institute workers from the Northwestern States and Canada have signified their intention of being present, with a view to effecting an international organization. This will close with a convention of prominent institute workers,

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JOSHUA. - How's that?

Maria.—Well, instead of cavortin' raound tellin' w'at he'd deu, the paper says he just staid to home and "mended his fences."—Puck.

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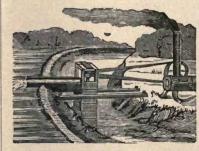
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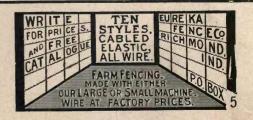
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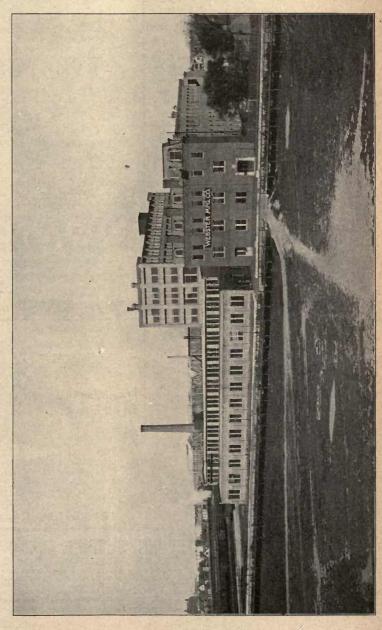
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make especially for pumping purposes. We believe it will fill a much needed want, as it has a large capacity and is very reasonable in price. The engine is a good 2 to $2\frac{1}{2}$ H. P., and is able to pump 3,000 gallons of water per hour, lifting it 40 feet and putting it up to a height of 60 feet.

The motto of this company is "Quality first and always," and they have carried it out in building this engine. While it is offered at a low price which will be attractive to users, yet the engine is made up first-class in every particular.

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Ah, yes! Were it not for that face I might have been too well content to trace The barren path of careless indolence; But now I toil and ask no recompense, Save that throughout the lonely nights and days

On that dear face I may forever gaze.

"Tis not a face with pouting, rosebud lips And sparkling eyes, whose softest looks eclipse The twinkling of a thousand midnight stars; It is a face that anger never mars, A face unchanging through the changing years-A face that beardless youths and hoary seers Alike pursue, alike would call their own-A face impassive as the chiseled stone-It is the classic goddess on our dollar; That is the face we all delight to follow. W. G. J.

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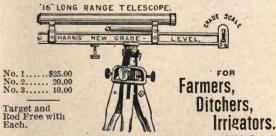
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Pensions were granted Kansas people as follows: Erastus E. Reams, Leavenworth; Burgess Mason, Kansas City; William Hartranft, Canton; James W. Cashner, Argentine.

MAGAZINES.

The contents of the leading magazines are as follows:

Century Magazine.-New York. March. A Personally Conducted Arrest in Constantinople. F. Hopkinson Smith. e of Napoleon Bonaparte.—XVII. Life of

Sloane of Mapore Hondon Slums, Edward Marshall, On the Track of the "Arkansas Traveler." H. C. Mercer.

Mercer.
John Randolph of Roanoke, Powhatan Bouldin.
The Elder Dumas. Emily Crawford.
The Perils of Small Talk. Allan McL. Hamilton
Ways and Means in Arld America. William E.:
On an Author's Choice of Company. Woodrow
Our Foreign Trade. Fenton T. Newbery. Hamilton. William E. Smythe. Woodrow Wilson.

The Cosmopolitan.-Irvington, N. Y. March. Empire-Building in South Africa. Albert Shaw.
The Mystery of Grant. Adam Badeau.
True Story of the Death of Sitting Bull. E. G. Fechet.
Old English Silver, S. Leverett Johnson.
Upland Pastures. Ninetta Eames.
The Art of Making Up. Madame Sara Bernhardt.

Scribner's Magazine.-New York. March.

History of the Last Quarter Century in the United States.—XII. E. B. Andrews. Carnations. J. H. Connelly. Florentine Villas. Lee Bacon. Miss Mary Cassatt. William Walton. French Binders of Today. S. T. Prideaux. British Opinion of America. Richard Whiteing.

McClure's Magazine.-New York. March. Abraham Lincoln. Ida M. Tarbell.
A Century of Painting, Will H. Low.
Personal Reminiscences of Col. E. E. Ellsworth. John
Hay.
Chapters from a Life. Elizabeth Stuart Phelps.
Scientific Kite-Flying. Cleveland Moffett.

Cunton's Magazine .- New York. February. English Vlew of the Monroe Doctrine. English View of the Monroe Doctrine.
Is the Duty Added to the Price?
Sherman and Cleveland on Finance.
Chartism: Its Character and Influence. M. McG. Dana.
Tariff Reductions and Flat Money. R. E. Dodge.
The American Federation of Labor. M. McG. Dana.
Compulsory Arbitration. Jerome Dowd.
Principles of Party Organization. Frank L. McVey.

The Forum.-New York. March.

The Forum.—New York. March.
Family Life in America. Th. Bentzon.
The Nicaragua Canal an Impracticable Scheme. Joseph
Nimmo, Jr.
The Army as a Career. Oliver O. Howard.
The Best Thing College Does for a Man. Charles F.
Thwing.
Some Municipal Problems. E. W. Bemis.
The Manitoba School Question. Goldwin Smith.
Cost of an Anglo-American War, Edward Atkinson.
An Alliance with England the Basis of a Rational Foreign Policy. Professor Sidney Sherwood.
The European Situation. F. H. Geffeken.
Spirit of Racing in America. Jno, Gilmer Speed.
Manners and Customs of the Boers. T. Loraine White.

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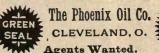
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THE IRRIGATION AGE.

VOL. IX.

CHICAGO, APRIL, 1896.

No. 4.

THE ART OF IRRIGATION.*

CHAPTER XI. IRRIGATING WITH FURROWS (Continued).
UNDERGROUND WATER. FLOODING.

BY T. S. VAN DYKE.

A LL systems of making water soak side-ways from ditches are practically the same, no matter by what name called or how many distinctions may be multiplied from different ways of running the water. Filling up the soil with water from below by seepage from large ditches around the tract differs somewhat from this, but hardly enough to justify calling it a new system. Sometimes it is done unintentionally and on a very large scale, as in parts of the great San Joaquin valley in California, where the steady seepage for several years from large ditches and waste water has raised the level of underground water, over tens of thousands of acres, from sixty or seventy feet to six or seven or less. Sometimes it is unintentionally done on a small scale by the use of too much water on land having hardpan, clay or other impervious material beneath. On all land not well drained it is liable to happen from very ordinary waste after the land has been irrigated several years. And sometimes it is done intentionally where the conditions will allow it. And where the soil is very "leachy" (lets water through too fast) it may be advisable to do it as the cheapest method, and in some rare cases the only method. Its simplicity commends it in many cases where other methods are far better, and it is the favorite of many a lazy man who has plenty of water, because there is nothing to do but let it run. Sometimes the ditches are made around the tract, sometimes across it, sometimes both; often they

are large and often small, but it is all the same, and is generally possible only on land that is quite sandy.

At first glance it seems fine to dispense with work and cultivation in this way, and have the roots go down out of the way of evaporation. Being a kind of subirrigation, it has all the attractions of that system with apparently none of the disadvantages of underground pipes.

Time, however, shows that many things are injured by having the roots in standing water, while some are killed. It is doubtful if anything does as well that way as under surface irrigation on land well drained. It certainly does not if the water becomes stagnant and heavily impregnated with salts of iron, making it "sour," as it is often called. And if the water is clear and changing, with a steady underground flow, it is doubtful if anything does as well in it. While alfalfa will grow on such ground, and often give large yields, it has been proved over and over again that alfalfa, on well drained open soil with surface irrigation, is still better. The same is true of the pear, which will often do well on ground too wet for other deciduous trees, but with plenty of water does still better on well drained benches. With the orange and lemon, and most of the deciduous fruits, there is no longer room for question. Grapes of some kinds will bear heavily on wet land, but you can see the difference on higher soil, while the finest corn I ever saw was

^{*}All rights reserved by the author.

on land twenty feet from water and heavily irrigated with warm water on the top. Eight acres averaged 115 bushels to the acre, and most of it was over fourteen feet high. I have seen very fine corn in the same region and on the same kind of soil, low along the river where the water was but a foot from the top, but it would not run over ninety bushels. On the whole, it is pretty safe to say, do not irrigate in this way for anything unless there is some special economy in it, and then plant only such things as you are sure will stand it.

Where the head of water is great and the feeding flume large enough, furrow irrigation may become practical flooding, as in the picture given in Chapter X of bad furrow irrigation. If you had 180 streams of one miner's inch each, and should run them for twenty-four hours on ten acres, this would be one half of 360 twenty-four-hour inches, or about half the whole allowance for the year under many of the best water rights in Southern California. This would equal about nine inches in depth, or three-quarters of an acre foot. Nothing but very coarse sand could take such an amount of water as that, even if distributed over the twenty-four hours evenly in steady fine rain. The folly of trying to put it on from a ditch must be apparent. Yet that was about what the irrigator was trying to do in the picture of bad furrow work. It leaches out fertilizers, cuts the soil and is in every way bad. When the soil is so coarse as to require such large streams you are approaching the point where it is best to flood. ing but sandy or gravelly land will need streams of an inch apiece, and nothing but land nearly level will stand them. have, therefore, the conditions for flooding, and had better do it directly than in-You can then save your fertilizers, avoid cutting and do better work.

Where you can get a large head of water for only a short run you are generally compelled to flood no matter how well small streams might run upon the soil. This is liable to be the case at times on many ditches depending on the flow of a stream and not supplemented by reservoirs. If the amount of water used is based on the average of the summer flow, as it should be instead of on the minimum, on which no one can figure and which should not be established as the limit of the capabilities of any country,

there will be times when a run of large heads for a very short time may be the only way of accommodating all consumers. This is liable to happen at the driest and hottest part of the season when vegetation is demanding the most water to evaporate and will suffer the most if it does not have it. And sometimes it wants it furnished very quickly, too. In such case you may have to take a hundred inches of water for five acres and handle it all in two hours or so. And you may have to be on hand at three o'clock in the morning to take your turn, and every minute you lose is so much gone, for at the precise minute it is cut off. occasions are short, but you should figure on them as possibilities. You should find out such matters before buying or planting, and especially before deciding what system to adopt. Sometimes it is easy to change from flooding to furrows and vice But sometimes it is not. It will depend very much on how you have prepared the ground.

PREPARATION FOR FLOODING.

If land is to be flooded even more care should be taken in preparing it than if it is to be watered from furrows. depth of water in all the checks should be as nearly the same as is consistent with reasonable economy in grading. will not do to economize too much in this. In many cases it would ultimately pay to terrace the land somewhat in very broad steps, taking care to leave no jump-off places, but smoothing it down so that machines can run over it. If the checks are not level then the water stands deeper in one place than in another. For best results the water should be rushed over the land in as thin sheets as possible, and never allowed to stand longer than requisite for enough soaking. Otherwise uneven wetting results and the lower part is puddled too much, both bad whether cultivation is to follow watering or whether the piece is in something permanent, like alfalfa.

If your land has a slope of twenty-five feet to the mile, which looks almost level on a large plain, checks one hundred feet wide would have the water in the lower side about six inches deeper than on the upper side. If you increase the depth so as to give enough to the upper side you injure the lower, for the six inches it already has are too much for almost any crop or orchard. If you reduce the size of the checks to twenty feet you still have over an inch difference. This is all right for orchard work, but checks as small as that are generally a nuisance for alfalfa or most field crops. To bring the larger check right would require only a few inches shaved off the bottom of the upper side and spread over the lower. To do this well is not very expensive and would in most cases be repaid by the better crops and greater ease of handling the run of water. This is best done by large scrapers that carry dirt easily in large quantities, like the Fresno scraper. man who attempts to economize at this stage of irrigation is very foolish and will ever regret it. Preparation of the ground is two-thirds of the battle, and this is the last case in which to underestimate the enemy. To repair the mistake afterward is generally difficult and in case of orchards nearly impossible.

It will also pay to have the flow from the feeding ditch regulated by something better than dirt and the water had better be diverted by something better than a dam of earth or a piece of cloth on two skewers or a bit of board stuck in the ground. Even a sheet iron dam is not the best. It costs little to fix all these things well at the outset and a good gate of lumber with a cut off from the main takes very little material and can be made at home.

The shape of the checks into which the field is to be cut to hold the water is of no consequence. If permanent they are best made according to the contour of the land; if temporary, square. Where the ground will permit it is common to make them square, but they are made in all sorts of shapes according to the lay of the land, the nature of the crop and the whim of the irrigator. If they cannot well be made rectangular for orchards it is pretty good proof that the land has not been well prepared and you had better stop right there and go back and prepare it. When so prepared it is more easy for temporary work to make them in squares or "oblong squares," as rectangles are called, than any other form.

The size of the checks will depend upon the slope of the land, the head of water at your disposal, and the nature of

the crop.

The more nearly level the land the

larger you may make them. But you must first be sure that the head of water is large enough to fill them quite rapidly and discharge from the upper ones to the lower ones quite rapidly. Otherwise you will have slow and uneven flooding, which should always be avoided. If you should try to flood forty-acre checks with a fiftyinch head of water-a cubic foot a second -you would find yourself in trouble if you had many to fill.

The speed with which the water will flow through the checks and pass to the next ones will depend also on what is in them. If there is a stand of alfalfa or grain in them the stalks will retard the flow. You must therefore have a larger head of water. If you have plenty of water, in heads large enough, it is generally best for all field crops to make the checks as large as the slope of the ground will permit. Especially is this the case if they are to be left there permanently and be run over with mowing machines. care must be taken not to have the ridge too high on the lower side. This may, however, be partially obviated by making them very broad at the base, and this should always be done where they are to be left and run over by machines instead of being broken up every time by cultivation. In all cases they should be so strong that there is little danger of their breaking. For if one goes the extra rush of water may take the next one, and in careless work one may see a whole line of temporary checks go one after the other as certainly as a row of bricks.

LARGE AND SMALL CHECKS IN MEXICO.

The largest checks I have seen were near Lerdo in the state of Durango in Mexico. While I have to depend on memory I am certain that I have there seen fields of corn and cotton half a mile square, irrigated in one check almost perfectly level, and one cornfield in which I hunted ducks several times was fully a mile square. The water stood all over it at nearly uniform depth and the irrigating head that I saw turned into it was fully five thousand inches or one hundred cubic feet a second. This work was well done and the crops were very fine. I cannot see that smaller ckecks would have been any better. And while a larger yield to the acre could have been had by better

plowing and cultivation, it is not easy to say that the difference would have paid.

There is little land anywhere that will justify such large checks. This was the most level land I have ever seen, and was probably once the bed of a lake fed by the River Nazas. The water was practically of uniform depth throughout and took over two days to spread thoroughly over it. There were dry places all through it, but so very low and small that they amounted to nothing. They came, no doubt, from uneven plowing, but the water soaked through them fast enough.

On the other hand, the smallest checks I have ever seen used for field crops were in Mexico on a large hacienda near Jimenez. Several thousand acres were planted in wheat, and the whole was in checks about ten feet square. I was over it several times in January and the stand of wheat was very good and it no doubt made a fair crop. The land was black adobe. The checks were made with the common wooden plow of the country-a bit of log six or eight inches in diameter sharpened at the end. They had in places been patched up with a hoe, but the whole work was quite well done. It could pay only with very cheap labor like the peon labor of Mexico. The checks were undoubtedly so small on account of the slope, which did not appear great on account of big mountains in front, but which must have been considerable to require so much labor.

METHODS OF THE CHINESE.

For lettuce, radishes and other vegetables to be grown very early, the Chinese market gardeners often use checks even smaller than ten feet, and even on level ground. They seem unable to tell the reason, but it no doubt is because they can in that way run a thin sheet of water over the whole, get it in the ground more evenly and in less time per square foot than could be done with larger checks. In this way there is no such chilling of the

ground or puddling in places as if more water were turned into larger checks. By taking care in this way they raise good vegetables in fair quantity without any cultivation, even very tender ones suffering little if any.

But when it comes to later crops and things to be grown on a larger scale, the Chinaman finds this small checking too slow. He then makes them of many sizes and shapes. For tough stuff like cabbage he will sometimes make them half or even the whole length of the field, and from twenty to a hundred feet wide. He prefers furrows for almost everything where they can be used, but when they will not work to advantage he does not hesitate to flood. But he tries always to rush the thinnest sheet over the ground in the shortest time, unless the nature of the crop makes it unprofitable to spend too much work on it. He is a good irrigator and no one can afford to ignore his work. It is worth studying for the principles involved, and cheap as his labor is, he is still a close figurer in economizing work.

For alfalfa and other field crops where the land is flat enough and the head of water large enough, forty acres make about as large a check as is generally consistent with economy. In the San Joaquin valley of California, probably the greatest alfalfa region in the world, many are larger than that. Many are also smaller, and it is difficult to see any advantage for ordinary farms in having them over ten acres for anything. While it is well to imitate the methods of prosperous settlements, you must still remember that the secret of success in flooding is to get the water in the ground as rapidly as possible and in as even sheets as possible, avoiding all puddling and scalding, which will result if the water is allowed to stand anywhere too long. Other things being equal the smaller the checks the more easy it will be to do this.

(To be Continued.)



WATER SUPPLIES FOR IRRIGATION.

CHAPTER IV. THE DEVELOPMENT OF UNDERFLOWS.

By F. C. FINKLE, C. E.

HE term underflow is often applied to any water below the surface of the ground. In this way it is sometimes employed to designate both artesian and ordinary sub-soil water. Such an application of the term is decidedly improper and should be discouraged as far as pos-As the term itself expresses, it means water which is both under the surface and flowing. It can, therefore, neither mean ordinary sub-soil water, which is standing water merely filling the voids in the sub-soil, nor artesian water. which is confined under pressure in underground reservoirs and channels, and flows only when the impervious layer confining it is perforated by artificial means.

Since underflow water does not exist on the surface it cannot be taken by simple diversion in the same manner as the surface flow of streams. When its utilization is contemplated for irrigation purposes the first step to be taken after its existence has been determined is to bring it to the This is termed developing it. Before the mode of development is fixed upon there are several things which should be carefully determined. The most im-

portant of these are:

(1) Point where the water is to be, or can be used for irrigation.

(2) Points where development is practicable.

(3) The probable volume of underflow. If no tract of land requiring irrigation is found to exist sufficiently near and below the bed of a stream possessing an underflow its development for irrigation purposes will of course be a useless undertaking. While it is a rare occurrence, indeed, to find such a case in any arid region of the earth, yet it may occur and sometimes does.

Rivers of slight inclination and high banks are often encountered, and in such cases territory which can be irrigated from them is difficult to reach by means of a gravity system. In doubtful cases

the only way to determine such questions as the existence or extent of a body of land which can be irrigated from the underflow of a stream, and the cost of conveying the water, is by making surveys. Frequently no surveys are necessary for determining the point where the water can be used, as irrigable land exists in abundance and the fall of the stream and surrounding country is much greater than necessary.

After a tract of land susceptible of being benefited by the water in a degree which will insure the undertaking to be profitable has been located, a suitable place for the development of the underflow must be sought. Such a place must, of course, be selected at an elevation sufficiently higher than the land to be served to render the conducting of the water to it possible by gravity flow.

The point for developing an underflow should be as low down on a stream as it is possible to find one, in order to derive benefit from as large an area of watershed as practicable. The narrower the canyon of the stream the more easy it will be to develop the underflow by any of the methods which can be employed. A dam, tunnel or cut will be more cheaply constructed across a narrow canyon than across a wide one. A place where the depth from the surface down to bed rock or to the impermeable stratum underlying the underflow is shallow is always a desirable point for making the development. Shallowness to the bottom of the underflow is even of more importance than a narrow channel.

But both are of much importance and should be combined in as large a degree as possible in seeking a favorable place for the development of an underflow.

If the proposed development is to be made by a cut, tunnel or submerged masonry dam, a point on the stream where the grade is rapid should be selected. This is important as a factor in reducing the cost of the proposed works to a minimum.

In streams of rapid descent a shorter cut or tunnel will suffice to reach the same depth, and in draining the foundations for a submerged dam less pumping will be required, as short drain cuts or tunnels can be employed.

PROBABLE VOLUME OF UNDERFLOW.

We have already seen how the existence of an underflow can be determined by the natural characteristics of the watershed and channel of a stream. By the same means the volume of the underflow can also be judged. That is to say it can be determined whether it is probable that the underflow is quite considerable, or whether it is small and unimportant. It is impossible, however, to determine the exact amount of the underflow from any observations in regard to the channel and watershed of a stream. In fact it can be seen very readily that it is a difficult matter to ascertain the volume of a stream of water underground percolation flowing by through sand and gravel. Some experiments covering the velocity of water percolating through such materials as usually comprise the beds of rivers have been made by engineers. From these experiments the following laws have been deduced: The velocity of percolating water varies directly as the density and character of the stratum through which it percolates, and as the square root of the one-hundredth part of the product of the slope and depth of the percolating stratum. quantity of water percolating through any formation depends upon the mean velocity of percolation and the area of cross-section of the stratum of percolating water.

By plotting the results of such experiments as have been made with varying grades, depths and classes of material they have all been found to follow quite closely the following formulæ:

$$v = 0.1m \sqrt{\frac{ds.}{100}}$$
 and

 $Q = a (0.1m \sqrt{\frac{ds_*}{10.0}})$, in which the letters denote the following factors:

v = the mean velocity of the percolating water in feet per second.

Q = the number of cubic feet of perco-

lating water per second.

a = area of cross-section occupied by water in the deposit containing the percolating water, in square feet.

d = mean depth in feet of the deposit containing the percolating water.

s = mean fall or inclination per foot of the deposit containing the percolating water, in feet.

m = a variable factor.

The value of the factor m depends on the density of the deposit of materials through which the underflow percolates. A deposit in which a large portion of the mass consists of voids affords an easy outlet to percolating water, while one with less voids makes percolation more slow and difficult.

The following values for the factor m have been deduced from such experiments as have been made and recorded:

For coarse boulders of nearly uniform size, m = 1.0.

For coarse boulders with some gravel, m = 0.9.

For boulders with considerable gravel, m = 0.8.

For coarse gravel, m = 0.7.

For coarse gravel with some sand, m = 0.6.

For coarse river sand with some gravel, m = 0.5.

For ordinary sharp river sand with very little gravel, m = 0.4.

For coarse quicksand, m = 0.3. For medium quicksand, m = 0.2. For fine quicksand, m = 0.1.

For intermediate cases between those enumerated above the values of m can be

approximated from those given.

While it is not believed that the formulæ given above will produce results which are entirely exact, yet, if the true conditions are arrived at, employing the formulæ will give as close results as are required for all practical purposes. The best method for determining the depth and area of crosssection of an underflow is by making borings at intervals across the stream from the top to the bottom of the water-bearing formation. If the expense of making such borings cannot be incurred, the only way to determine these things is by approximation from such characteristics of the stream as are observable. The slope of the river bed, the proximity of bed rock at the sides of the channel, the dip or angle of the materials comprising the sides of the river bed, the width of the channel, the distance from the surface flow to the top of the underflow and other things of a like nature are often guides, which help to determine the probable depth and sectional area of the underflow.

Sometimes the underflow of a stream does not occur in the usual form of a continuous sheet of water gradually percolating through the sand and gravel of a river bed. There are instances where the formation is partially cemented and obstructs the free percolation of the underflow water. In cases of this kind the passage of the water is obstructed by the solidity of the formation and it breaks through in small streams, which are separated from each other by intervening dry formations.

It sometimes occurs in instances of the latter class that the formation in the channel of the stream is so much more compact than that adjacent to the stream that the underflow is either partially or wholly deflected laterally and flows in a different direction from the stream itself. This, of course, does not occur in narrow, rocky canyons, but on streams with low banks of permeable material. On account of cases of this nature we often find that streams with a very large and good watershed possess little or no underflow. absence of underflow in streams, however, is generally due to other causes. are the opposite of the characteristics of a watershed and stream channel, which have been previously outlined as essential to the creation of an underflow, and their discussion in detail is therefore deemed unnecessary.

ESTIMATING AND DEVELOPING IRREGULAR UNDERFLOWS.

Such underflows as have been discussed in the preceding paragraphs may be said to be irregular both from the fact of their being exceptional and on account of their departure from established rules. quently their volume cannot be estimated in the ordinary way, nor can they be developed like regular underflows. mates as to the quantity of an irregular underflow must rest largely on the skill and judgment of the engineer who makes the investigations. Sometimes there are circumstances which can make the results nearly certain, even in irregular cases, but usually the conclusions arrived at are merely rough approximations.

The most satisfactory method of developing an irregular underflow is by means of a system of tunnels and shafts crossing the stream at nearly right angles. The shafts are necessary in order to make the running of drifts on different levels possi-

ble so as to follow the levels where streams occur in the formation. The first work should always be the sinking of shafts, after which the tunnels can be commenced back on a level to reach the required elevations.

MODES OF UNDERFLOW DEVELOPMENT.

The different methods of developing underflows are as follows:

(1.) By cuts. (2) By tunnels. (3) By submerged dams.

The conditions and circumstances surrounding each case must determine which of the above methods is to be employed in making the development. Without entering into a discussion of the principles governing the designing and construction of these structures, which matters will be discussed in succeeding chapters, we will now briefly discuss the rules governing the application of the different methods of development already enumerated.

THE DEVELOPMENT OF UNDERFLOWS BY MEANS OF OPEN CUTS.

Cases are rare where open cuts can be employed wholly as a means for developing the underflow waters of a stream. The objection to this mode of development in the ordinary run of cases encountered in practice is, that most streams are subject to heavy floods and overflow at certain times of the year. As the development usually has to be made in the bed of a stream, such floods or overflows would cause open cuts to be filled up and obliterated, so that the work would have to be done over periodically. The following instances often occur, however, in which this objection does not apply: (a) when the outlet of the underflow drain can be located outside of the overflow channel and the drain under it in such a manner that it can be covered over after being supplied with a flume or pipe; (b) when the stream is not subject to greater floods than can be controlled by aprons or bridges across the cut.

When either of the above conditions obtains cuts can be considered as a method of development, provided always that the underflow at the proposed point is not too deep to be reached by means of a cut. Economy and practicability prescribe that a cut for the purpose stated should not exceed a certain depth. Both the cost of construction and the cost of future

maintenance must be considered in determining whether a cut should be made or some other method employed. The materials encountered in river beds are commonly of a loose character and will not stand on abrupt slopes.

It is therefore necessary to make the slope of the sides flat, which increases the quantity of earth to be moved very rapidly

as the depth of the cut increases.

When the limit in depth has been reached at which a tunnel can be constructed and maintained equally as cheaply as a cut the former is to be preferred, even if a cut will be equally as safe.

DEVELOPMENT BY MEANS OF TUNNELS.

Tunneling is undoubtedly the most customary method of making underflow developments. It is always safe provided the proper location is made and the proper method of construction is employed. The mouth of the tunnel should invariably be located at one side of the channel of the stream and above the high water or flood mark. The mouth of the tunnel should also be located far enough down or away from the channel so that sufficient grade will be obtained to preserve a depth when the tunnel penetrates under the channel, which will place its depth at a point safely below the erosions liable to occur from the heaviest floods. At times an open cut and. a tunnel can be combined more advantageously than the use of either one singly. When for a long distance outside of the regular channel and above the flood line the tunnel would run at a shallow depth below the surface, a cut can be made, thereby causing a considerable saving,

until a depth is reached at which a tunnel would be more economical.

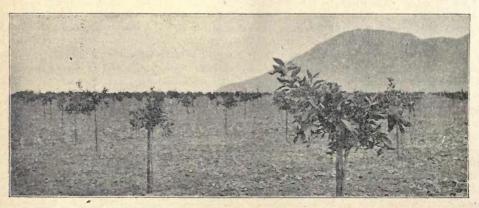
SUBMERGED DAMS AS A MEANS OF DEVELOP-MENT.

When the underflow is near the surface, and a point where bed rock approaches the sides of the canyon and is found at a shallow depth can be located, a submerged dam is possibly the cheapest method of development. This will prove to be true more particularly when the grade of the channel is light, so that a very long tunnel would be required. Before a submerged dam is undertaken it must be known with certainty that the bed rock is continuous and unbroken, so that no water will escape under the dam after it is completed. object of a submerged dam is to raise the underflow to the surface, and leaks in the foundation, which will grow and undermine the structure or allow the water to escape under the dam, must be avoided.

Submerged dams can sometimes be constructed with some impervious stratum other than bed rock for a foundation. Such cases, however, are quite rare and undertakings of this sort more often result in failure than in success.

Tunnels and submerged dams are often combined in the development of underflows. A tunnel may be used in connection with a submerged dam for the purpose of draining the foundation to facilitate construction, or a dam may be constructed across the channel at some suitable point on the line of the tunnel for the purpose of collecting the underflow into the tunnel, or for holding it back and regulating its flow when only a part of it is required for use or when it is not to be used at all.

(To be Continued.)



A YOUNG ORCHARD IN CALIFORNIA.

OREGON AS A FRUIT GROWING REGION.

BY H. T. W.

THE eastern portion of the State of Oregon was, for a long time, regarded as being inferior to the strip of country lying west of the mountains, on account of the lack of rainfall, but since the advantages and possibilities of irrigation and diversified farming have become more generally recognized it has been the scene of active development. Its immense beds of valuable minerals, its rivers and vast cattle ranges made it a country of great wealth, and of late years its agricultural and industrial growth have kept it fully abreast the progress of modern civilization.

In the eastern portion of the State bordering upon the Great Snake river lies Malheur county. Here is a country of hills and valleys, watered by running streams, enjoying the genial and healthgiving climate which has been the fame of Southern Idaho. In this county, near the lively town of Ontario, is located the one thousand acre K. S. D. Fruit Farm. This farm has attracted wide attention on account of its magnificent park and beautiful driveways, Grand Boulevard being sixty feet wide and two miles long. growing orchards, the broad acres of alfalfa and clover, surrounded on all sides by thousands of tall shade trees and flowing streams of clear water, give the place the appearance of an ancient private estate.

This farm consists of about 1,000 acres, of which 360 have been planted in alfalfa, forty acres as a winter apple and pear orchard and ten acres as a prune and garden orchard, the balance being fenced and under ditch but not cultivated. There are 27,000 shade trees and 6,000 fruit trees on the farm which is located within one-half mile of the main line of the Union Pacific Railroad. The water for irrigation is supplied through two canals, one each from the Owyhee and Malheur

rivers.

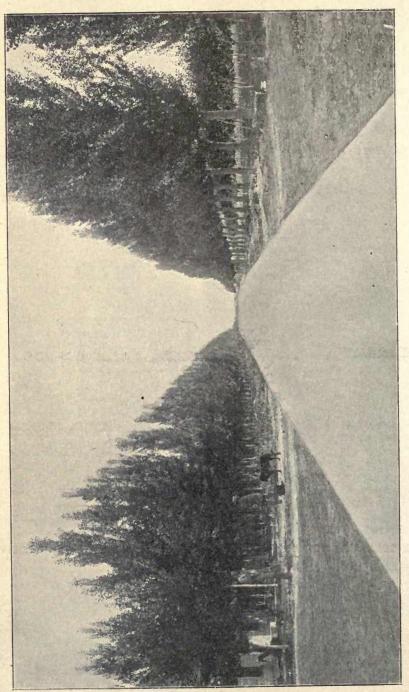
Six years ago the owners, Messrs. Kiesel, Shilling and Danilson, adopted a broad policy of improvement—fencing and cultivating the land, setting out fruit and

shade trees, making roads, erecting barns and outbuildings, and finally taking an active part in the building of the irrigation canal which was to furnish the water so necessary for the growing of crops and orchards. At the present time they are making preparations for the setting out of a large number of fruit trees, making a veritable orchard of the country.

veritable orchard of the country.

It is only a short time since the fruit industry was started in Eastern Oregon. Formerly the large producing orchards lay west of the Cascade range in the valleys adjacent to the coast cities where the great rainfall assured abundant crops of grain and fruit without irrigation, but they are beginning to see that the countries which the Creator has kept hidden away under a mask of apparent barrenness are in reality His greatest store houses of wealth, and that the irrigated orchards of Eastern Oregon are destined to be the great fruit producers of the State. Scarcely anywhere can the apple, prune and pear be grown so successfully as in the Snake River valley, near Ontario. The soil, climate and everything is especially adapted to fruit culture. This land produces some of the finest apples, prunes and pears in the world, also grows to perfection peaches, cherries, plums, apricots, grapes, nectarines, etc. Indeed, their twenty-four ounce apples are the prize takers wherever they make their appearance, while the peaches (twelve inches in circumference) are looked upon with astonishment.

While the largest profits in this country will ultimately come from the orchards, the first yields will come from alfalfa and vegetables. For feeding horses, beeves, sheep and stock hogs it is all that is required. With porous soil, plenty of water and warm seasons, after the first year three crops may be cut, aggregating six to eight tons per acre, besides the pasture thus afforded. It sells in the stack from four to eight dollars per ton. Another industry receiving considerable attention is the cultivation of hops. The



GRAND BOULEVARD, TWO MILES LONG, ON THE K, S. D. FRUIT FARM, NEAR ONTARIO, OREGON,

average yield is about 1,700 pounds to the acre, but with good cultivation this can be increased. The suitable soil, favorable climate and reasonable price for material, labor and transportation will enable growers to do business at a profit.

The average yield per tree of apples and pears is from three to five hundred pounds, and sell at from one to two cents per pound. And this is sometimes greatly exceeded.

ortation will
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Wheat yields from twenty to forty bushels per acre; oats from forty to sixty bushels; potatoes from one hundred and fifty to three hundred bushels. The average retail price of the grain crops is about \$1.25 per hundred.

Messrs. Kiesel, Shilling and Danilson deserve credit for their enterprise in building up new industries in the Eastern

Oregon country.

HOW LARGE SHOULD THE IRRIGATED FARM BE?

THE number of acres which the average irrigated farm should comprise must, of course, depend upon a variety of condi-While there is no doubt that farming operations may be carried on profitably on large areas of irrigated land by single owners, yet it is with the small holding that most men are specially concerned. In fact, the small farm is the key to highest success in a broad sense, when considered as affecting communities, large districts or even States. Local conditions must largely determine the acreage in the irrigated farm. In many cases individual caprice will alone rule in this connection, but in well regulated colonial settlements the matter may be largely controlled by the management of the original subdivisions of the land. Perhaps wisdom would suggest only the outside. limit of the amount to be sold to any one purchaser. Subdivision into fiveacre lots is often convenient, and the limit of original purchase may be fixed at some multiple of that amount not exceeding, say, forty acres.

The object generally to be attained by compact colonial settlements should be kept steadily in view, and the land so peopled as to render it most valuable, not only to the purchaser but to the colony. For it must be remembered that the entire community gains or loses by every accession to its ranks. Every industrious, honest, thrifty and progressive colonist who is content to make a comfortable home on a ten-acre lot is worth far more to a settlement than the man who indifferently manages the poor cultivation of eighty acres and will not be satisfied with a small holding. If the settlement be mainly devoted

to fruit culture the acreage in the farms may generally be smaller, perhaps, than if the land be devoted to dairying or some other pursuit.

The best possible results to flow from colonial settlements upon irrigated lands within the arid belt will be found to come from the cultivation of the land by the owner and his family, or by them with the aid at harvest time of a little outside help. The limit of the holding, therefore, should generally be fixed by a full consideration of this fact in connection with local conditions of climate, products and markets. In districts where orcharding is a recognized specialty it has often been found that ten acres, intensively cultivated and intelligently managed, have proved entirely adequate to the support of a family, and also to give a tidy surplus at the end of the year. But good crops and good prices are not always certainties, even in the irrigated regions, and perhaps a greater diversity of production should be undertaken in most places within the new regions developing upon the arid domain.

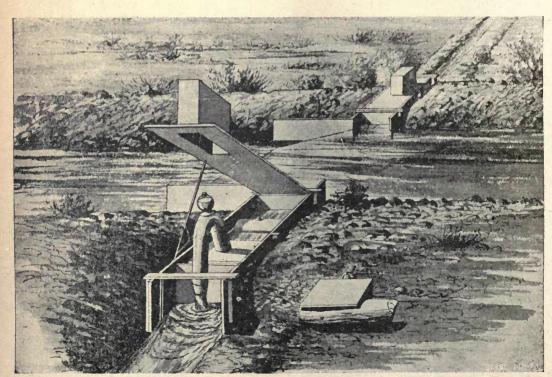
A ten-acre orange or lemon grove, in good bearing, should ordinarily give satisfactory results to almost any modest family, but insect pests, frosts and other calamities sometimes cut short the profits, and thus bring discomfort if not great inconvenience to the orchardist. Ordinarily, and in most settlements, it will be found better to undertake a somewhat diversified husbandry, even on the small holdings appropriate to such localities. The more self-supporting a family can be the better. To be brief, everything should be produced that can be produced with less cost or

greater convenience and profit than outside purchases of such commodities would entail. The butter, eggs, meat, fruit, vegetables, milk, honey, jellies, sauces, oil, wine, etc., required by a family should, if possible, be produced on the home acres, though reserving enough space to produce the surplus crop deemed most valuable for the locality and surrounding conditions.

Every foot of land should be made to yield some profitable crop. The barbarism of waste everywhere seen about the large farm should have no place on the snug little irrigated farm of the colonial settlement. If the season will justify, two or more crops of vegetables should be produced on the same ground each year, and the land should thereby become better for the extra cultivation and fertilizing. Every scrap of fertilizing material should be carefully preserved and applied to the land in due season. Ashes and meat scraps should be utilized in making soap wherewith to wash fruit trees, and leached ashes should never be thrown into the street, but applied to the land. A compost vat should be a prominent feature of the small farm, into which all material available for plant food should go, to be prepared to nourish

the growing crops. In short, the little irrigated farm should be the owner's laboratory, wherein he should transmute the air, the water, the earth and the sunshine into gold.

It will be readily seen that the intensive farmer here contemplated must be not only intelligent but educated and industrious. Backwoods methods will not win on such a farm, and the man who knows too much to learn anything about his business from books and papers should betake himself to the desolate cattle or wheat ranch, for he could not succeed on the small, neat, wellordered farm of ten or twenty acres. ablest lawyers are they who know most of the precedents long established, and the physician ignorant of the best work of others in his profession would be justly set aside for a man of the times. It is the same with the farmer. He who depends upon his own knowledge and experience alone is too often trying to do a large business on a very small capital. To read, to study, to experiment, to think and to reason are absolutely essential to success on the small irrigated farm, and he who is above or below this plane would better betake himself to other fields of endeavor.



DEVICE FOR MEASURING WATER.

RECENT DECISIONS UPON THE SUBJECT OF WATER RIGHTS.

BY CLESSON S. KINNEY.

N a recent case decided by the Court of Appeals of Colorado, the court held that where deeds of water rights provide that, when the grantor (an irrigation company) sells a number of water rights equal to its estimated canal capacity, and twothirds of those rights are paid for, the title to the canal shall pass to the grantees, and the company received payment for more than two-thirds of all the rights sold, if it sold rights in excess of the capacity of the canal, so that the consumers could not receive the quantities of water purchased, the grantees are entitled to have the title to the canal conveyed to them. And the court further held that the fact that the company's reservoirs might increase the capacity of the canal to furnish water did not excuse the company from executing its contracts in such deeds.

(La Junta & Lamar Canal Co. v. Hess,

42 Pac. Rep. 50.)

In another case the same Colorado court held that a deed containing no reference to a ditch which supplies water to the land conveys no interest in the ditch.

(Child et al v. Whitman et al, 42 Pac.

Rep. 601).

In the case last above mentioned the appellees offered no evidence of any transfer or deed conveying the interest other than a deed to the land on which the water had been used. The conveyance contained no reference to the ditch, nor were there any apt words of alienation in Mr. Justice Bissell in rendering the opinion said: "It is well established that an interest in a ditch is property, which may be transferred or conveyed subject to the same limitations and restrictions which attend a conveyance of real property. A conveyance of land without mention of a water right cannot be taken to transfer an interest in a ditch, although the water carried may have been used upon the land. In this State it is regarded as an independent right, which may be the right of subject of sale and conveyance, but a technical transfer is essential to vest in the transferee a title to the water."

APPROPRIATION OF WATER-FORFEITURE BY NON-USER.

The Supreme Court of California held, in a case decided November 19, 1895, that under the Civil Code of California, § 1411, declaring that an appropriation of water must be for some useful or beneficial purpose, and that when the appropriator ceases to use it for such a purpose the right ceases, not only to the water rights, but also to the rights of way for ditches, given by the Rev. Stat. of the U. S. §§ 2339, 2340, over land which at the time of the appropriation belonged to the public, are lost by non-user for five years, the period for obtaining the prescriptive title, or losing the prescriptive right by non-user.

(Smith et al v. Hawkins, 42 Pac. Rep. 453.)

This seems to the writer to be a correct construction of the sections of the statute. But it seems as though the statute was exceedingly liberal upon this subject. In this western country where water is the very life of agricultural development, five years seems to be a long period of time to wait before a water right, which the prior owner has to all intents and purposes abandoned, can be declared forfeited by his non-user of the same.

In the opinion the court said: "In this State five years is the period fixed by law for the ripening of an adverse possession into a prescriptive title. Five years is also the period declared by law after which a prescriptive right depending upon enjoyment is lost for non-user; and, for analogous reasons, we consider it to be a just and proper measure of time for the forfeiture of an appropriator's rights for a failure to use the water for a beneficial Considering the necessity of purpose. water in the industrial affairs of this State, it would be a most mischievous perpetuity which would allow one who has made an appropriation of a stream to retain indefinitely, as against other appropriators, a right to the water therein, while failing to apply the same to some useful or beneficial purpose. Though, during the suspension of his use, other persons might temporarily utilize the water appropriated by him, yet no one could afford to make disposition for the employment of the same involving labor or expense of any considerable moment, when liable to be deprived of the element at the pleasure of the appropriator after the lapse of any period of time however great."

WASTING WATER.

In the case of Roeder v. Stein, decided by the Supreme court of Nevada in December, 1895, and reported in the Fortysecond Pac. Rep. 867, the court discussed the subject of wasting water by those who had originally appropriated it for some beneficial use or purpose. And the court held that where it appears that the plaintiff made the first appropriation, by means of a certain ditch, of enough water to irrigate 125 acres of land, and that subject thereto the defendant had made an appropriation, the court has the power to direct that the plaintiff must use the water through that ditch or by other means that will be least wasteful. The court further held that the first appropriator is only entitled to the water to the extent that he has use for it when economically and rea-

sonably used.' When he has that he cannot prevent others from making use of the surplus; and the court also further held that after others had acquired rights to the use of the water of the stream, the first appropriator for irrigating purposes cannot, to their detriment, change the method by which he conveys it to his land. so as to increase the waste that naturally occurs in such conveyance. The court in the opinion said: "As already remarked, water is too precious to permit its being wasted. Conveying it through a ditch, even, will always cause some loss, and if the distance is great or the soil loose or porous the loss will be considerable. This, within any reasonable expense, is generally unavoidable. But, however this may be, if the appropriation has been made before others acquired rights in the stream, after that no change can be made to their detriment. The first appropriator must continue to use it in at least as economical a manner as before, and cannot change the method of use so as to materially increase the waste. Such a change may be forbidden and parties 'may be compelled to keep their flumes and ditches in good repair so as to prevent any unnecessary waste." Citing, Barrows v. Fox, 98 Cal. 63; 32 Pac. Rep. 811.



THE EDGEMONT CANAL IN SOUTH DAKOTA.

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DIVERSIFIED FARM

In diversified farming by irrigation lies the salvation of agriculture

HOW TO PREVENT INJURY FROM FROST.

BY F. C. BARKER, NEW MEXICO.

N studying methods of preventing injury from frost it is necessary to have a clear knowledge of how and why the tempera-

ture falls and frost is produced.

The surface of the earth is continually losing heat by radiation into space, but during the day it usually receives heat from the sun more rapidly than it loses it by radiation, and therefore it grows warmer. Radiation, and consequent loss of heat, takes place most rapidly when there is nothing to obscure the sky. Clouds or any other obstruction act as a screen in retard-The escaping rays of heat strike the obstruction and are driven back to the earth. This is why frost is more likely to occur on a clear night than when the sky is cloudy. It also explains why smudge fires, by forming a screen of smoke over the orchards, are a protection against frosts.

Cold air is heavier than warm air, and this principle causes the air on slopes, as it becomes chilled by radiation, to flow down into the valleys, where it accumulates and becomes injurious. We thus understand why trees on the foot hills often escape injury from frost, while those in the adjoining valleys are damaged. Smudge fires are only effective on broad, flat expanses of land. In narrow valleys the cold air comes down from the hillsides and gets underneath the smoke. On windy nights the danger from frost is lessened by the warmer air above getting mixed with the colder air below.

The above theories of the radiation of heat and the falling of the colder air are tolerably well recognized by all orchardists, but there is another and perhaps more important law of nature, which is but little understood, and this is the "dew-point"

Every one knows that the atmosphere holds a very considerable amount of water in the form of vapor, and that this invisible vapor, which is invariably present in greater or less quantities, can always be condensed into water if the temperature of the atmosphere be sufficiently lowered. If the condensation takes place at temperatures above the freezing point of water, the moisture is deposited as dew; if below the freezing point, the condensation is in the form of frost. To fully comprehend what follows, it must be understood that the temperature at which condensation begins is called the dew-point, and this varies with the amount of moisture or vapor in the air. The greater the proportion of moisture the less the fall of temperature required to condense it into dew or frost. When the air is saturated with moisture the dew-point will be reached at a higher temperature than when the air is dry. For instance, in a dry atmosphere the dew-point may not be reached until the thermometer falls to 28 degrees Fahrenheit, when frost forms. At this point peach buds are seriously injured.

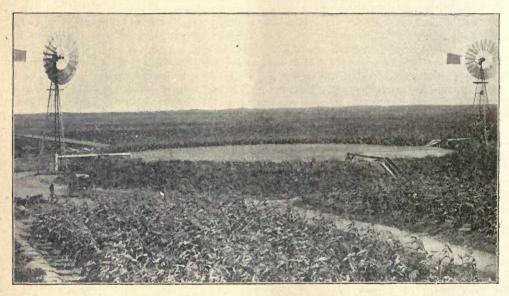
If, however, you can artificially add to the amount of vapor in the air by keeping the land moist by means of recent irrigations, then you raise the dew-point and frost may be formed at a higher degree of temperature, or say at over 30 degrees Fahrenheit, which is the amount of cold necessary to injure peach blossoms. If, therefore, you can prevent the temperature of the atmosphere from falling to 30 degrees, you are safe. At first sight it may appear that if the vapor in the air freezes at 30 degrees and the indication of heat still continues, the temperature will continue to fall until injury results. But here a very wonderful natural law comes into play.

Of course it is well understood that an enormous amount of heat has been required to convert water into atmospheric vapor. This heat is latent in the vapor, and when the latter is condensed into frost

or dew this great amount of latent heat is given off into the atmosphere, and tends to keep it at an even temperature. You have two forces at work. Firstly, the radiation or loss of heat is reducing the temperature to the dew-point, while the heat given off by the condensation of the vapor is keeping up the temperature just as fast as it falls to the dew-point. The result is that unless the radiation is very great the temperature does not fall. course this theory does not work except in cases where slight frosts would otherwise occur. For instance, where in a dry atmosphere the dew point would not be

amount of heat that was expended in forming the vapor, and how enormous this is may be judged by the fact that the condensation of a pint of water from its vapor state will result in enough heat being given off to raise more than five pints of water from the freezing to the boiling point. We thus arrive at the seeming paradox that the formation of frost from vapor produces heat in the atmosphere.

In using smudge fires it should be understood that the heat of the fire has but little effect in diminishing the intensity of the frost, almost the entire protection



WIND MILLS AND RESERVOIR OF E. E. FRIZELL, NEAR LARNED, KANSAS.

30 acres in alfalfa, 25 acres orchard, 10 acres Irish potatoes, 5 acres sweet potatoes, 5 acres onlons, 5 acres cabbages; total, 80 acres.

reached before the temperature had fallen to 29, the dew-point may be reached at 31 in a moist atmosphere. the former case the peach buds would be destroyed, while in the latter case they would escape injury. Hence the object of keeping the surrounding atmosphere moist, and this can be attained by frequent irrigations or even spraying of the orchards at the critical period of blossoming. That this is not a fallacious theory has been proved over and over again by orchardists who have kept their land well saturated with water during the blossoming season, and who have escaped injury from frost while their neighbors who have failed to follow this practice have suffered. heat given off by the condensation of vapor into dew or frost is exactly equal to the

being gained by the screen of smoke pro-The efficiency of smudge fires may be greatly increased by spraying them with water, thus adding vapor to the atmosphere and raising the dew-point, for as has already been explained the dew-point is reached at a higher temperature when the vapor in the air is in-Moreover, by spraying the fires, creased. the heat, which would otherwise establish an upward current of warm air that conducts the heat upward and beyond the space needing protection, is utilized in forming vapor and distributed through the lower stratum of air where it is most needed. As soon as this vapor is condensed at the dew-point, this latent heat is set free and tends to raise the tempera-Every quart of water thus evaporated and again condensed in the surrounding air is sufficient to raise the temperature ten degrees throughout a space eighty feet square and deep.

FERTILIZING ORANGE ORCHARDS.

BY W. C. FITZSIMMONS.

N no department of soil tillage does a knowledge of "book farming" pay better than in the production of fruits of various kinds. The question of fertilizing the soil in order to reach the best results in fruit production is one which few understand fully, and none can wholly comprehend without study and thought along the lines which science has traced as a guide to the intelligent horticulturist. Chemical analysis alone can properly determine the composition of fruits or other products of the soil, and it is by a study of results reached in the laboratory, that the orchardist is enabled to apply to his soil the proper ingredients in right proportions to produce a crop. The chief and most expensive substances entering into the necessary food for fruit crops of nearly all kinds are nitrogen, phosphoric acid and potash. Without definite amounts of these substances to feed upon, a full crop of perfectly formed fruit is impossi-It should be understood by all orchardists that Nature is inexorable in her demands, and when she asks for bread she will not be satisfied with a stone. other words, her call for nitrogen, phosphoric acid and potash must be heeded, or There is no appeal from this, and no orchardist should delude himself with the hope of deceiving her by substituting carbon, soda and magnesia or any other combination of ingredients, however captivating the name or small the cost.

Take an orange grove for example: At twenty four feet apart the trees would stand at the rate of about seventy-five to the acre. At ten or twelve years of age many trees will yield, say, seven boxes of fruit per tree, weighing about 500 pounds. Let us see then the amount and cost of the chemical ingredients which must enter into that 500 pounds of fruit, and without which it will be impossible to produce that amount on one tree. The principal chemical substances to be found in the orange and derived from the soil are: Nitrogen, potash, phosphoric acid, soda, lime, mag-

nesia, and oxides of iron, alumina and manganese, also sulphuric acid, silica and chlorine. All save the three at the head of the list may generally be disregarded, since repeated analyses have shown most soils in which orange trees are planted in the United States to be fully supplied with the small amounts required save perhaps lime. But lime is abundant almost everywhere and cheap, hence we shall confine this discussion to the three chief substances required. According to analysis made at the laboratory of the California Experiment Station, 500 pounds of seedless oranges contain 1.6 pounds of potash, .27 pound phosphoric acid and .92 pound With the prices of 5 cents a pound for potash, 6 cents for phosphoric acid and 15 cents for nitrogen these ingredients entering into 500 pounds of seedless oranges (presumably the product of one tree) would cost 23.6 cents; or, if lime be required, say 25 cents per tree. At the prices given, the absolute requirements of the fruit in the way of plant food would cost at the rate of \$18.75 per acre. If the soil already contains all or any part of these substances, it would, of course, lessen the cost of the annual fertilization. And right here is where many orchardists-in fact most of them-neglect an opportunity if not a duty. should have their soils analyzed for the chief ingredients here mentioned, and thus learn what they lack or how long the present supply will last. In fact, without some such guide, the orchardist is at a great disadvantage and must in a certain sense grope his way in the dark to reach results. But this is the requirement of the seedless fruit only, and takes no account of the growth of the tree itself and of the perfecting of the seed growth. For these purposes a further supply of each of the ingredients would be required, bringing the probable cost to 15 cents more for a tree large enough to bear 500 pounds of fruit. It is probable, therefore, that an orange tree producing as above stated uses each year some 40 cents' worth of fertilizing material. This must be already in the soil or must be put there by artificial means, else a crop to meet reasonable expectations cannot be produced. It is useless to attempt to replace one of these essential ingredients with some other substance. That is, the lack of potash cannot be supplied by an excess. of nitrogen, and vice versa. A chain is only as strong as its weakest link, and a fruit crop will be measured by the product due to the smallest amount of any needed ingredient which may be present in the soil. It is, therefore, of the greatest importance that a well-balanced ration of fertilizer be used so that the best results and no waste shall follow its application. If the soil be deficient in any one ingredient, putting on the others in excess will not bring a fruit crop. Most of these things are fairly understood by the foremost orange growers in Florida, but in California, owing to a richer soil, growers do not generally comprehend the science of fertilization. It is a common custom to apply nitrogenous fertilizers, such as sheep manure and that of dairies and horse stables, without much regard to other substances which a proper orchard fertilizer should contain. These things will all be learned in time, no doubt, but the object of this article is to call present attention to the great need of intelligent action along the line of fertilizing orchards, and if greater interest in the subject shall have been aroused the purpose of the writer will have been accomplished.

THE EASTERN STOCK FARMER SHOULD GO TO THE IRRIGATED WEST.

HE more I see of farming in the irrigated West the more I am convinced that our Eastern farmers have failed to appreciate the great advantages which irrigation offers to the producer of butter, cheese and pork, writes F. C. Barker, of New Mexico. In the first place, more milk and pork can be raised from an acre of irrigated alfalfa than from an acre of any other crop and at less expense. In the second place, dairy products and pork invariably sell for more money out West than they do in the East. For instance, in the town where I live fresh ranch butter is never worth less than 30 cents, and, although doubtless pure, will fall when we have a better supply, yet throughout New Mexico large quantities are still imported from Kansas, and it will be a long time before butter will sell for less than Kansas prices plus cost of express. Enterprising Eastern farmers who understand dairy farming ought to take advantage of this state of affairs and make their butter where it sells for the most money. That butter, cheese, pork, poultry and eggs sell for more money in the irrigated West than in the East requires no proof at my hands. The immense shipments from points farther east prove this beyond any doubt.

The question which will naturally be asked by the farmer is, whether butter and pork can be raised as cheaply on an irrigated farm as in States like Illinois, Iowa, etc. Personally, I feel more certainty upon this point than I do upon the question of prices. The latter are liable to fluctuation and beyond the farmer's control, whereas the only variation in the cost will be in the direction of further economy as the farmer gains experience. Enough has already been done to show that no crop is so suitable for dairy cows and pigs as alfalfa. Under irrigation it produces at least three and often four or five cuttings, making a total of three to five tons of hay for the year, the feeding value of which is at least equal to the best timothy hay, indeed it is considered superior by every one who has had experience with both alfalfa and timothy. I give the estimates in hay because they are more easily compared, and after all hay must be the basis of all stock feeding. But alfalfa is not the only stock food raised here. Corn, sorghum and cattle beet can be raised with the greatest ease and under very favorable circumstances to the stock feeder, and bran is always obtainable at reasonable prices. And last, but not least, the open winters make stables quite superfluous.

Dairy Cows' Rations.—Experience by practical dairymen in each of the States mentioned show that the following are good rations for dairy cows: In Pennsylvania, 10 lbs. corn fodder, 6 lbs. hay, $3\frac{1}{2}$ lbs. wheat bran, $1\frac{1}{2}$ lbs. cottonseed meal, $1\frac{1}{2}$ lbs. oil meal, $2\frac{1}{2}$ lbs. corn meal. In Illinois, $7\frac{1}{2}$ lbs. clover hay, $7\frac{1}{2}$ lbs. timothy hay, 12 lbs. corn and cob meal, 8 lbs. bran, $1\frac{1}{4}$ lbs. linseed meal, $1\frac{1}{4}$ lbs. cottonseed meal. In Colorado, 30 lbs. silage, 10 lbs. alfalfa hay, 10 lbs. clover hay, 5 lbs. wheat bran, 2 lbs. corn meal.

Kansas Fruit.—As a fruit-growing state Kansas is making a record. During 1895 there were in bearing 7,529,915 apple trees, 186,874 pear, 3,790,692 peach, 883-874 plum, 1,451,716 cherry, making a

total of 13,843,071 bearing trees. In addition there were 6,646,560 fruit trees not in bearing.

Subirrigation.—The assertion has been made and reiterated that subirrigation is far superior to surface irrigation. To find out the results and differences of these different methods, experiments were begun in 1890 at the Utah Experiment Station and have been carried on five years. Following is a summary of the whole matter:

First.—On a poor clay soil containing gravel, with the cobble rock drain, or on a better clay soil containing some sand, with the cement tile, the subirrigation was not so good as the surface.

Second.—The experiment covers ten trials, and in every trial but one the surface irrigation gave the highest yields.

Third.—During irrigation the soil immediately over the rock drains or the plugs in the cement pipes was over saturated, while that between the drains or pipes and between the plugs in the pipes was very dry.

Fourth.—On the soil of the station farm the system of subirrigation has proved an utter failure for grain or grass. On soil containing more sand it may be possible and is highly probable that better results can be obtained.

Fifth.—The system is so expensive that it is doubtful whether it could ever be applied to general farming. The results are so discouraging that no one is advised to put it in except on a small scale for trial.

Subsoiling.—There is every reason to believe subsoiling to be a valuable aid to the farmers on much Oklahoma soil. Observations made at the Oklahoma Experiment Station at some points in the Territory where subsoiling has been tried show, however, that it is very desirable to combine with subsoiling the growth of deep-rooted plants and other means of getting vegetable matter into the soil, not only at the surface but as deep as may be practicable. A good deal of soil in the Territory is of such nature that it will become overly compact again even after thorough subsoiling. The more roots or other vegetable matter it can be made to hold, the longer will it remain loose.

More Ventilation .- The discussion of the subject of tuberculosis in cattle necessarily involves the subject of the causes of the same which are often found in illy ventilated barns. The tendency of the farmer in winter is to get a large amount of warmth for his cattle so as to save the cost of feed. To secure heat he has supplied little room for his cows and has shut out the cold air as much as possible. authority upon the health of the cow says that the stable, to be healthy, should be well ventilated and free from draughts, and to accomplish this air should be admitted at the door line and sufficient space should be provided at the apex of the roof to allow the heated air to escape. hundred cubic feet of air is necessary for Shorthorns and their grades, and less, of course, for the smaller breeds.

Has Its Limitations.—Bran is much more highly thought of as feed than it used to be. But it has its limitations, and should not be relied upon entirely when fed alone. It is an excellent feed to give to animals that have a surfeit of corn, and should always form a part of the ration of fattening sheep. It is not so good for hogs, as its coarse texture makes it unpalatable. But fine wheat middlings have all the excellences of bran, and will be eaten in greater quantities by fattening hogs. The bran and wheat middlings furnish a greater proportion of albuminoids than corn has, and, therefore, supplement its deficiencies.

Advantages of the Irrigation Farmer.—The farmers of many portions of Texas and the West, generally, made fine crops last year, but our Pecos valley farmers have the comfortable assurance of just as good crops every year, while those in the districts depending on rainfall know that such another season may not come again in ten years. The irrigation farmer cares little for either a drought or a flood, as he is independent of each. In the first place floods are rare in the arid countries, and when they do come, in off years like the present one, the irrigated farm sheds the extra water as readily as it takes it in flooding the fields by irrigation. In short, the same preparation for flooding the fields prepares them for bearing off flood waters, while the rain farmer has to stand helplessly by and see much of his crop drowned by excessive rains. At many points corn is so plentiful that 15 cents is a good price for it, while here 70 cents is as cheap as any one has sold his crop of corn. The Pecos valley farmer can grow hogs enough on a few acres of alfalfa to use all the corn grown on a quarter section of ground, so that he can always market his corn at a good figure. The Pecos valley farmer who stays at home and attends to his business is the most independent man under the sun, for he is not mortgaged up to the eyes to the merchant, and he need never be. The Pecos valley farmer, one of whom we are which, is all right, with a bright and happy future. - Pecos (N. M.) News.

Lecturing the Old Style Farmers.— Time apparently hangs heavily upon many of our farmers. Prices of most of the products are so low that the business but little more than pays the running expenses. A radical change the whole length of the line is indispensable to anything like fair success.

Little less must be done, and accomplished in a great deal better manner, says The American Cultivator. It is entirely idle to expect to secure a profit over the cost of production of ordinary to poor goods. The best horses, the best cattle, sheep, dairy products and the like usually pay a good profit, and why? Because it does not cost so much to produce good stuff as the poor stuff costs.

The farmer who raises a good horse or a good ox wastes no feed. His feed is all food of production; he don't feed them a day without some grain. A good dairyman will make as much product from two cows as a poor one will from six. The good dairyman not only feeds the food of support, but as much of the food of production as his cows will bear and respond to, while the poor dairyman rarely finds much above the food of support, and of course loses most of that.

Farmers do not sell quite so much fertility when they sell stock as they do when they sell hay. If our farmers could provide themselves with first-class stock and learn how to feed it and care for it, they would rise in the scale of being in short time. It is their only way out. As a rule, from three to eight horses are kept

on a farm, and not a good one among them.

All This and More too .- On the subject "What the Granges Have Done," Senator Chandler of New Hampshire says: "They have promoted and secured their most natural object, better and more profitable agriculture. They have taken up by many wise heads the various questions of importance to farmers; have investigated and studied those questions; have searched the world over for answers, and at last many quick hands have put into practice and proved the soundness of the conclusions reached. There is hardly a method of farming which has not been improved through the influence of the granges. Better market gardening, better flowers, better staple crops, better forestry are the result of the inquiries, discussions, plans and experiments of the granges of America. This most fruitful subject of the results of grange action I leave to be amplified by others."

Butter and Eggs.—Poultry and eggs sold in Kansas during 1895 were valued at \$3,315,067. During the same period butter to the value of \$4,050,048 was sold.

Exercise is of the utmost importance for laying hens. One ounce of salt per day for one hundred hens is a good proportion. Supply grit liberally. Give the hens plenty of room and keep them warm.

Four hundred thousand sheep will be sheared in the pens around Casper, Wyo., this spring.

The Warren Live Stock Company of Cheyenne, Wyo., fed their sheep at Duncan, Neb., during the winter, shipping as many as eight carloads at a time to Omaha. The sheep were in prime condition and brought top prices.

The live stock industry of Kansas last year brought returns of \$40,691,074 for animals sold.

Fred Wachter raised 5,400 bushels of corn this year in this county from 120 acres, and did all the work himself, except six days' work cultivating. This beats the Iowa man and his two small boys, who raised 5,000 bushels, which is being so extensively quoted in the newspapers.—

Aurora (Neb.) Sun.

MANUFACTURES AND TRADE

Norfolk, Nebraska, has a candy factory. Bozeman, Montana, wants a creamery.

A LATE report says frost has injured the fruit in Arizona.

A colony of Dunkards is to locate in the Grand Valley, Colorado.

IRRIGATION will be tried on 100 acres of bottom land east of Atchison, Kan.

The Western Nebraska fair will probably be held the latter part of August.

American Investments rises to ask if we regard irrigation as an "art." We do.

Connecticut claims to lead the New England States in the matter of irrigation.

THE Iowa legislature has passed a bill forbidding the manufacture or sale of cigarettes.

Lincoln, Nebraska, will be the scene of the State Grand Army reunions for the next five years.

THE creamery at Albion, Neb., paid the farmers in that locality \$17,500 for milk, butter and eggs last year.

Nebraska, Missouri and Iowa are following the lead of Kansas and planting a large acreage to Kaffir corn.

IDAHO has repealed the law providing that the obligations of the State might be paid in either gold or silver.

A NUMBER of settlers from Idaho have laid out a new town to be called Grand Teton, near the Gros Ventre river.

A PARTY of 100 families from Arkansas and Iowa are going West to settle in the Jackson's Hole country, Wyoming.

A VINEGAR factory has been started at Albion, Neb., by Sylvester V. Parrot. Sugar beets will be used exclusively.

Washington has over fifty creameries, and the output for last year was about 2,500,000 pounds of butter, valued at \$312,500.

STATE Labor Commissioner Bird estimates that there are \$100,000,000 invested in manufacturing plants and raw material in Kansas.

THE Anthony salt plant has been sold at sheriff's sale for \$4,000. The city of Anthony, Kans., invested \$23,000 in this plant a few years ago.

THE Red Lake and White Earth Indian Reservations in Minnesota comprising 890,745 acres of land will probably be thrown open for settlement about June 1.

Shallow artesian wells in South Dakota cost from \$50 to \$300. Deep wells ranging from 500 to 1,500 feet cost complete about \$3.00 a foot. There about 400 shallow and 150 deep wells in the State.

PRESIDENT J. J. Hill of the Great Northern Railway Company has purchased 300 acres of land on the west side of Great Falls, Mont. This will no doubt be made the terminal grounds of this company.

The fast-thriving little city of Havelock, Neb., five miles east of Lincoln; on the main line of the Burlington railroad, is surrounded by a very fertile agricultural region, and is soon to become one of the important manufacturing points in the West. The principal shops of the Burlington & Missouri River railroad are located here, employing about 400 men and maintained at an annual expense of nearly half a million of dollars.

CANADIANS took the initiative in an international deep waterways convention held in Toronto during the summer of 1894. This was followed by another convention in Cleveland and more recently by one in Detroit. There is already uninterrupted passage from Chicago and Duluth to Buffalo for vessels drawing twenty feet of water, and the aim is to have the channel completed by deepening the canals between Buffalo and Montreal or New York. Community of interest among grain growers in the great West on both sides of the line has joined them or rather those who speak for them in a common effort to perfect water communication from the head of Lake Superior to the Atlantic seaboard.

MINES AND MINING OUTPUT

Anaconda, Mont., is to have a smelting plant.

THE Salt Lake Mining Exchange is a success.

SHERIDAN, Wyo., is to have a mining exchange.

NEBRASKA has an acute attack of the gold fever.

CRIPPLE CREEK now has a population of In 1892 it had 1,500. 60,000.

It is estimated that this year's output at Cripple Creek will reach 20,000,000 tons of ore.

THE annual capacity of the three smelters already erected in West Kootenay is given as 164,250 tons.

Extensive deposits of onyx have been discovered on the Big Laramie river within eight miles of the Cheyenne & Northern railway.

THE mining fever has struck Wheatland, Wyo. Several discoveries are reported from the country surrounding the busy little town.

It is estimated that 500 claims in the Cripple Creek district on which the owners failed to do full assessment work in 1895 have been jumped.

THE West has not a monopoly of the gold supply, although it has little to fear from competition elsewhere. The following is the gold output of Southern mines up to December 31, 1893: North Carolina, \$11,726,629.90; South Carolina, \$2,221,-590.90; Georgia, \$9,112,328.05; Alabama, \$242,994.19, and of Virginia, \$1,754,-785.02.

The mineral output of Idaho in 1895 was as follows:

0.11.0	Quantity.	(1)	Value.
Gold, fine ounces	125,517	\$	2,594,666
Silver, fine ounces	. 4,030,180		5,214,498
Lead, pounds	65,752,037		2,301,321

Total....\$10,110,485

This is an increase of \$316,405 over the previous year.

Shoshone county, Idaho, produced 63,861,660 pounds of lead in 1895.

THERE is \$96,325,122 of capital invested in the Lake Superior iron mines and their equipment; and in docks and railways and vessels for the exclusive transportation of ore, from the upper lakes to Lake Erie ports, etc., \$136,916,963, making a total of \$233, 242, 085.

THE largest gold brick ever cast in the Black Hills was recently deposited in the First National Bank of Deadwood. came from the Cyanide Works, weighed a trifle less than 125 pounds, and was worth about \$30,000. It was the result of a fifteen days' run.

THE Golden Fleece Mining and Milling Company of Lake City, Colorado, reports:

1892, to Jan., 1896		\$729,252.19
Less expenditure, Sept., 1892, t Jan. 1, 1896 Less Insurance and Construction accounts	. \$209,149.88 n	213,830.64
Balance profit Dividends paid		\$515,421.55 401,979.85
Surplus on hand Jan. 1, 1896		\$113,441.70

THE Chicago Mining and Mineral Board have adopted the following rates:

The state of the s		
Per 100 Sl	ares.	
Stock selling at 25c and under	\$ 25	
Stock selling at over 25c and under 50c		
Stock sening at over 250 and under 500		
Stock selling at over 50c and under \$1	1 00	
Stock selling at over \$1 and under \$2	2 00	
Stock selling at over \$2 and under \$5	9 00	
Stock selling at over \$5 and under \$10	5 00	
Stock seiling at over \$10 and under \$20	6 25	
Stock colling at \$90 or over	19 50	

For the first time in the history of Colorado, the gold output for the year just closing exceeded in value that of silver. A careful computation of the mineral output for the year from the statistics attainable shows the following: Gold, \$17,-340,495; silver, \$14.259,049; lead, \$2,-955,114; copper, \$877,492; total, \$35,432,-150. For 1894 the output was: Gold, \$11.235,506; silver, \$14,721,750; lead, \$3,268,613; copper, \$767,420; total, \$29,-993,290. The increase in gold production is almost wholly from the Cripple Creek district.

LIVINGSTON, Mont., wants a smelter.

THERE was no smelter in the Black Hills from 1876 to 1882.

An appropriation has been made to run the mint at Carson, Nevada, another year.

THERE is a field for the development of copper properties in the Yellow Jacket District, Idaho.

The waterpower plant at the mine of the Boston and Montana Company in Montana has a capacity of 7,500 horse power.

THERE are two feet of solid copper ore and twelve feet of free milling gold ore on the Indian Claim in the Yellow Jacket District, Idaho.

It is claimed that there are deposits of very rich gold quartz in Southern Oregon, although placer mining has attracted most of the attention heretofore.

THE Western Mining World says it is scarcely possible to glance through a paper published anywhere in Idaho without reading of new mine discoveries or increased prosperity in the mining industry.

The report of the Minister of Mines of British Columbia shows the output of gold by districts as follows: Gold mining engaged the attention of, on the average, 1,050 white men and 979 Chinese and Japanese, besides those engaged in Trail Creek division, the newest as well as the richest in the province, but for which unfortunately no gold returns were sent in. The output of the others was, by districts, as follows: Cariboo, \$282,400; Cassiar, \$22,575; East Kootenay, \$17,575; West Kootenay, \$10,520; Lillooet, \$40,663; Yale, \$237,311, a total of \$636,544 of the yellow metal, exclusive of the Trail Creek division, as previously mentioned. Of this total all came from placers except \$135,000 from the quartz mines at Fairview and Camp McKinney. Even without Trail Creek the returns for 1895 are the largest since 1878, new methods having brought about a revival of the industry in temporarily abandoned fields. Since the beginning, in 1858, \$55.000,000 in gold has been taken from the fields of this province. Appended to the gold statistics is the statement that in 1895 the gold, silver and lead in the ore from Kootenay was estimated at \$2,176,-000.

British Columbia also claims to have oil fields.

ALASKA'S output of gold last year is estimated at \$3,000,000. Of this \$800,000 came from the Yukon placer mines.

COAL mining made no progress in British Columbia during 1895. There are immense quantities of coal, but it can not be mined to advantage until the fields are reached by the railroads.

The production of the oil field for the past year was nearly three times as great as that of the previous year, amounting altogether to 1,368,750 barrels. The average price received was 50 cents per barrel, or \$684,375 for the entire output. According to the estimate of the oil exchange, there are 250 wells which have been operated during the year, the mean product of each being about fifteen barrels daily.

The mineral bearing portion of the Belknap Indian reservation in Montana that will probably be declared open for entry within the next six months, is located on the north slope of the Little Rocky Mountains, covering an area of nearly thirty-five square miles. This area is almost wholly made up of abrupt porphyry buttes and steep, broken mountains. The drainage of the district is by tributaries of Milk river; three large creeks issue from this district out onto the vast plateau lying between the Milk river and the Little Rockies.

Since 1890 the gold in European banks has increased by \$623,200,000. Of this the Imperial Bank of Russia has gained \$185,800,000, the Bank of France \$167,-400,000, the Bank of England \$111,000,-000, the Austro-Hungarian Bank \$79,800, -000 and the Imperial Bank of Germany \$39,000,000. The gold comes from the American monetary circulation and from the production of the gold mines. At the end of 1895 the Bank of France and the Imperial Bank of Russia between them held \$776,600,000 in gold, a little more than half the stock of gold in the European banks, and this does not include the gold in the Russian treasury, which is estimated at \$510,400,000. The gold in Germany, Austria-Hungary and Italy amounts to \$336,000,000 and that in the Bank of England to \$580,800,000.

PULSE OF THE IRRIGATION INDUSTRY

EAST AND SOUTH CATCH THE IRRI-GATION FEVER.

HE agricultural papers of the East and South are discussing irrigation. Various experiments have been made during the past season in portions of Pennsylvania, Ohio, New York and New Jersey; also in North and South Carolina and other Southern States. The results have also attracted the attention of the daily press, and lengthy articles are being published. Wonderful as these achievements are in the Southern. Eastern and Middle States, they are eclipsed on the former arid lands of Western America because of the more thorough irrigation there. elaborate, displayed article of several columns in the New York Times will do a world of good in waking up the old style farmers of the entire country. lowing is an extract:

Not the least remarkable of the many picturesque anomalies which the cosmopolitan population of Long Island City presents is a colony of Chinese farmers, located on a high bluff overlooking Bowery bay. It was founded a few years ago by Shen Ho Joe, the son of a mandarin who made a fortune in the cultivation of every form of growing thing which flourishes within the great wall of China. Previous to the advent of Shen, the Chinamen of New York and the neighboring cities were forced to depend upon the Pacific coast for vegetables of their own

peculiar cultivation.

Shen's initial effort created a commotion among the truck farmers of Astoria. His beans were as large as an ordinary-sized radish, and all the other celestial vegetables were the envy and admiration of the neighborhood. The gourmets of Mott street were in ecstasies of delight over the new venture and the demand for Shen's vegetables far exceeded the supply. In order to meet the growing demand for garden truck which came from Mott street alone, five other Chinamen

started rival farms adjoining that of Shen Ho Joe a year afterward. Shen meanwhile had established a prosperous line of trade and had saved a snug sum of money from the proceeds of the first year's crop.

In the spring of the second year he sunk two wells on his farm for irrigation purposes and built a sausage factory and a large manure tank, from which liquid fertilizers are spread over the ground by means of a rubber hose. This innovation revolutionized Chinese farming in Astoria. The same kind of soil afterward yielded twice as much net for Shen as for the others. Of course, gradually, the influence of this progressive man extended throughout his neighborhood, and the old-fashioned methods of watering and manuring the ground soon gave way to new methods. The Chinese farmer from time immemorial has been a great believer in irrigation.

At the end of the third year Shen Ho Joe had acquired a competence and sold out his farm. With the proceeds of his three years' venture he sailed for China, leaving Yu Lee, Yung Gee Tschiu, Chu Lick and Yumb Yab in undisputed pos-

session of the field.

The soil of the celestial farms is sandy and poor. The fields are divided into squares called wells, from their resemblance to the Chinese character signifying a well, surrounded and furrowed by ditches.

There are upward of fifty different kinds of vegetables grown on this celestial farm.

DR. RUSK ON THE MORMONS.

The Rev. Dr. John Rusk, of the Militant Church, Chicago, is not following the policy of the ordinary orthodox preacher. He is taking up live subjects of interest at present. In a recent sermon he referred to the enterprise and thrift of the Mormons. "A man's share in what is going on in this world is not a dog's share nor a hog's share, but a man's share," he



CLESSON S. KINNEY, OF UTAH
The author of the articles on "Irrigation Legislation"
now appearing in The Age,

"How shall he get a man's share? said. By getting a home. The Mormons settled that in a superb way. They traveled West till they came to the superb valley of Salt lake. Brigham Young's plan was to have every man at work and every man in a home. A home a man's share. Not only that, but he overcame the isolation of agricultural life by settling a town with farms about it. He kept his people from mines, the thirst for gold, and held them to land and home. In addition, he associated his people so that they operated factories, mills, railroads, telegraph lines, stores and all that pertain to life in a community. It has become the example and pattern of the new colonial movement, and its success means hope for the city-bred man as well as the farm born. Whilst I must dissent from polygamy with all my being, I must say that it is the only religion which compels every man to own his own home. It teaches that no man has a right to own one more acre than he can use, a great Christian lesson of unselfishness. They found a desert and made it a paradise, because they taught that God made the earth for all and not for a few. Necessity taught them that no man

had a right to waste one drop of the precious water with which they irrigated their lands; their religion and the religion of Christ teaches that a man has a right only to so much of God's land as he can The Mormons are not allowed to fence in a prairie, nor are they rewarded for keeping land idle by having taxes reduced. It is a part of their religion to make the waste places blossom forth and to turn idle lands over to the industrious to improve and own what they do improve and use, but not one acre more. That religion places a premium on industry and unselfishness; that part of it is Christlike, and they live nearer Christ in this respect, far nearer, than the vast majority of socalled Christian people. Fully 98 per cent of the Mormons own their houses and the land on which their houses stand. I want to see the time when every Christian owns his home. I want to see a practical use of the Christian religion as I believe Christ intended it. I have visited the Mormons and found them most delightful and companionable, all of them industrious, and many highly cultivated."

VALUABLE STATISTICS.

The assessable property of Arapahoe county, Colo., is reported at \$82,133,000.

Nebraska has 352.028 children of school age. According to the usual calculations this would indicate that the State has a population aggregating 1,760,000.

The general land office report for the fiscal year of 1895 shows some very interesting figures relative to the business transacted by the local land office in North Dakota. At the Bismarck office 887 entries, covering 138,000 acres, were made. The total receipts were \$14,116.09. Devil's Lake land office shows 1,067 entries, and total receipts of \$19,441.56. The Fargo office shows 766 entries and total receipts of \$9,755.25. The Grand Forks office shows 1,234 entries, and the receipts were \$20,193.52. The Minot office shows 86 entries and receipts of \$1,105.77.

The total of land transfers for last year was 132 millions, an advance of twelve millions over 1894. There is a falling off of forty-eight millions as compared with 1891 or 1892, but it must be remembered that there was a great amount of specula-

tive dealing in real estate during those years, and some property changed hands many times. There is no reason to find fault with the volume of business for 1895.

In 1860 the assessed valuation of Washington was \$4,394,735, with a population of 11,694; in 1870 the valuation had increased to \$10,642,863, with 23,955 population; in 1880 the valuation was \$23.810,693, with 75,116 population; in 1892 the valuation was estimated at \$400,000,000, with 375,000 population. To-day it is estimated at \$450,000,000, with the population estimated by Governor McGraw at 415,000 January 1, 1896. The state is in good financial condition, with a low rate of taxation.

The population of Nebraska is 1,058,-910. Value of improved farms in 1890, \$402,358,913. Value of property per capita, \$1,205. Total valuation of real and personal property, \$1,275,685,514. Value of manufactures at the last census, \$93,037,794.

Kansas has a native population of 1,206,332; foreign, 128,402, making a total of 1,334,734. The percentage of foreigners is very small. Over 30,000 people have moved to Kansas from each of the States of Illinois, Missouri, Iowa, Indiana, Ohio, Nebraska and Pennsylvania, Illinois leading with 145,449 and the others following in the order named.

The total assessment last year on railroad property of the Santa Fe alone was \$68,309,321; the tax paid on that, \$1,744,-761, which, with the addition of the tax on town lots, lands and auxiliary companies, made the total amount about \$2,000,000. The highest rate last year was 3.67 per cent in Oklahoma; the lowest rate, .97 per cent in Texas. The highest rate of taxes per mile, \$504, paid in Iowa; the lowest rate per mile, \$96, paid in Texas. The Company pays more taxes in Kansas than in any other State; the total sum this year will be about \$800,000, a rate of 3.5 per cent, or nearly \$300 per mile.

The assessed valuation of property in Utah in 1895 was \$97, 983, 525. The total export value of the mineral product in 1895 was \$8,312,352. Computing the gold and silver at their mint valuation, and other metals at their value at the seaboard, would increase the value of the mineral product to \$14,519,959. There

are 19,816 farms in Utah, and 17,684 of them are absolutely free of incumbrance. Total acreage irrigated, 417,455. The amount of ranch and range was \$1,259-566 in 1894. The number of industrial concerns was 880 in 1894, employing 5,054 laborers, paying in wages \$2,275,118, representing a total capital invested of \$46,417,246, and turning out a product of \$6,678,118 annually. The population of the State is 247,326.

WHAT THE TORRENS LAND TITLE SYSTEM IS.

Chicago, in the recent election, adopted the Torrens land title system, and there is general interest throughout the West to know what that system is. It has been in successful operation for years in England, Prussia, Australia and in different parts of Canada, and it has proved wherever tried to be in the interest of the whole people. Sir Robert Torrens, from whom the system was named, once spoke of the benefits of it in this manner: "It has substituted security for insecurity; it has reduced the cost of conveyances from pounds to shillings, and the time occupied from months to days; it has exchanged brevity and clearness for obscurity and verbiage; it affords protection against fraud; it has largely reduced the number of chancery suits by removing those conditions that afford ground for them." By act of the legislature last June, the Torrens system became a law of the State of Illinois "in such counties of the first class as shall approve of said act by a popular vote." Cook county (Chicago) so approved. The evidence of a title registered under the Torrens system is a single paper—a certificate of title. Abstracts are, under this system. done away with. Titles will be registered upon the public records upon the judgment of the registrar and two expert examiners that there is a good title. There is a five years' limit for the contesting of the titles registered, and after the expiration of this period this certificate is a first evidence of ownership, and is incontestable. No one can deny your When a transfer is to be made, the owner presents the deed, together with the certificate of title, to the registrar, the deed merely authorizing him to transfer the property on the public records to the purchaser. All questions concerning the validity of that transfer are settled at that time and forever. The saving in expense and delay are great items.

SUGAR BEETS.

A beet sugar convention was lately held in Fremont, Neb.

Twenty-five hundred acres will be sowed to beets in the San Juan valley in California.

The people of Chadron, Neb., have raised \$25,000 to give as a bonus to the establishment of a beet sugar factory.

Over 450 acres of beets were raised in Clay county, Nebraska, last year, bringing the grower the contract price of \$5 per ton.

The Oxnard Beet Sugar Co., of Grand Island, Neb., agree to pay \$5 a ton for all beets with 12 per cent of sugar, and a graded scale for beets that fall below that percentage.

A bill has been introduced in the Iowa legislature calling for a bounty of one cent a pound on sugar manufactured from sugar beets, sorghum or cane grown within the limits of the State.

The fifteen sugar factories in Sweden worked, in the campaign of 1895–96, 538,708 ton of beets, and the refineries produced, from October 1, 1893, to September 30, 1894, 63,650 tons of refined, and, in the same period 1894 to 1895, 72,298 tons.

At the meeting of the Beet Growers Union in Chino, Cal., recently, the permanent organization was completed by the election of W. T. Hayhurst as president; Elmer Scott, vice-president; W. Baker, treasurer; W. M. Monro, secretary, and E. M. Day, W. M. Monro and W. Baker as executive committee.

In Utah it is stated that the average cost of cultivating, harvesting and delivering a crop of twelve tons of beets per acre is from \$28 to \$35, and with the average yield last year of 11.54 tons an acre the farmer has an income of \$49.05 an acre or a net profit of from \$14 to \$21, besides getting \$28 to \$35 in cash for his labor.

NEBRASKA CANALS.

Canals for irrigation purposes in Western Nebraska are making considerable headway and quite a number are in successful operation for a part or the whole of their length. The best and latest estimate of the mileage of constructed and proposed canals is something over 2,000 miles, of which 1,250 are now completed and the

remainder under way. This mileage is divided among 389 claimants of water under the State law. There are supposed to be almost or quite as many projects in existence or active preparation whose promoters have not yet made formal application to the authorities, but it is presumed that these are generally of small size and of less general importance. More than a million dollars has already been expended in irrigation works, and as much more will be required to complete the State's system. The number of acres of land covered by constructed ditches is about 854,000-by this is meant land to which water may be applied. The area really in crop under ditch for 1895 is less than 150,000 acres, but it will be more than doubled this year.

BOOKS AND MAGAZINES.

No publication that comes to our table is more welcome than that special exponent of Southern California most appropriately named "The Land of Sunshine." We may also add that no publication with which we are acquainted has a more distinctively local color and flavor than this, and the color and the flavor are both well pleasing. One fault we must allege, if it be a fault; and that is the habit so common among politicians during election times of claiming every thing in sight. It does not seem at all probable that an All-Wise Providence ever intended that all the good things of this world should be packed away in one corner thereof to the exclusion of all the rest of creation. As we study this great law of compensations, which seems to pervade the whole universe, it seems much more likely that when we put every advantage and disadvantage into the balance, the sum total of the differences between men and places is much less than we are generally willing to allow.

However, when every item is set down on both sides of the book, California of the South is still a land of beauty and richness; a land of corn, and wine and oil; a land to which all of us who have ever lived there hope some day to return; and meantime we have many a backward glance over the shoulder, and many a long drawn sigh of discontent. It is a land of eternal beauty and "The Land of Sunshine," is worthy of its habitat.

Dr. CHAS. STIRLING.

The April number of Scribner's Magazine contains an article by Henry Norman on the "Quarrel of the English-speaking Peoples." Mr. Norman was the correspondent sent to this country by the London Chronicle during the Venezuela affair. There are a number of very interesting articles in the April issue.

The April McClure's will contain what is about the first really authoritative and direct account yet given of Professor Röntgen and his discovery of the cathode rays. Immediately on the announcement of the discovery, the editors of the magazine cabled Mr. H. J. W. Dam, of London, to hasten to Würzburg, and talk with Professor Röntgen in his laboratory, and learn all there was to be learned of the new marvel in photography. The paper will be illustrated with a portrait of Professor Röntgen and numerous photographs by the new process. A supplementary article by Cleveland Moffett will tell what has been done in America with the cathode ravs.

The Lincoln paper in McClure's for April will describe Lincoln's first debate with Douglas—twenty years before the famous debate of 1858—with passages from an almost unknown speech of Lincoln's in reply to Douglas. It will also contain the true story of Lincoln's courtship and marriage, clearing away forever a mass of scandal and falsehood that gossip has piled up regarding these incidents in Lincoln's life. Portraits of Lincoln and Mrs. Lincoln and numerous other pictures will accompany the paper.

THE CATHODE RAY.

It may be briefly explained, without going into the details of a very technical subject, that ordinary light is regarded as due to vibrations which are at right angles to the direction in which the ray travels, but that in the mathematical theories of light, other vibrations, in the direction of the ray, are indicated, though wholly unknown in experience hitherto. If the new rays prove in fact to be of this character, so as to realize indeed the long sought longitudinal vibration, the discovery is of the first importance in science, and will hardly find its equal in interest since the discovery of the law of gravitation; for it reveals a new mode of action of force,

governing a wide range of phenomena and effects which, until now, have lain entirely outside the bounds of our cognizance.—Prof. A. W. Wright, in the April Forum.

SIR JOHN MOORE'S RETREAT.

The tale of Moore's splendid retreat, of his courage and calmness in loss and disaster, of his superb control of his men in their disappointment when Corunna was reached and no fleet was found there, of his brave fight with Soult on January 16, of the mortal wound which struck him down in the hour of victory, and of the self-forgetfulness which enabled him in the agonies of death to make all necessary arrangements for his men to embark on the belated ships—all this is a brilliant page of English history, perhaps the finest record in its course of glory won in retreat, of patience, moderation, and success in the very hour of bitterest disappointment. It was the spirit and example of Moore which made possible the victories of Wellington. - Prof. Sloane's "Life of Napoleon," in the April Century.

The American Book Co., of New York, have issued a valuable little book on the trees of the Northern United States. It gives the name and characteristics of each tree, describing in detail the bark and leaves. It is fully illustrated. The title is "Apgar on the trees of North America."

F. W. Woll, of the Wisconsin experiment station, is the author of a valuable work entitled "Agricultural Calendar for 1896," issued by John Wiley and Sons, of New York. It is filled with information for the farmer, fruit grower and stockman.

The Review of Reviews for April is an unusually full and complete number. Some of the features are the most interesting that have appeared in many months.

During the year just ended, gifts to the value of \$28,943,549 were made to churches, colleges, libraries, charities and the like, aside from their ordinary income, as against \$19,967,116 in 1894.

THE new state of Utah will start in by making a jury consist of eight persons instead of twelve.

THE EDITOR'S DRAWER

THE Kansas oil fields are being developed.

Montana shipped 306,460 head of cattle in 1895 valued at \$11,032,560.

A BILL has been reported favorably by the committee on territories of the United States Congress to admit a delegate from Alaska, thus making it a full-fledged territory.

The Canadian government has decided to continue the Chicago immigration office under the control of Peter F. Daley who has been doing such good work in behalf of the Northwest Territories.

Senator Hansbrough and Representative Cooper have introduced bills in the Senate and House respectively, to incorporate the Maritime Canal of North America to connect the Great Lakes and Hudson river. The capital stock is to be \$10,000,000.

IRRIGATION has proved itself the one great necessity for Idaho and the press and the people are co-operating for extensions of the great improvements already established. Numerous new irrigating companies have been incorporated the past season.

James B. Angell of Michigan, John E. Russell of Massachusetts, and Lyman E. Cooley of Illinois have been appointed by the President as commissioners to make inquiry and report upon the feasibility of a deep water canal between the lakes and the Atlantic ocean, under the act approved in March last.

THE Torrens Land Law is proving a success in Cook county, Illinois. It is the means of saving a great amount of time, annoyance and expense in the transferring of real estate or in borrowing money thereon. The abstract companies are naturally opposed to it but its utility has now been practically demonstrated.

The Western Mining World comes out in a bold stand against the statements of the Northwest Magazine that the West is destined to be an arid region forever. The Northwest Magazine has nearly always been inclined to look with disfavor upon anything tending to develop the irrigation possibilities of the Western States.

THE Burlington railroad has 50,000 acres of land for sale in Nebraska, principally located in Webster and Franklin counties in the southern part of the State, and in Antelope, Sherman, Greeley and Valley counties in the North Platte district. The land commissioner at Lincoln, Neb., is disposing of these lands on very reasonable terms.

The following prices show what the choice grain lands of the San Luis valley are worth to practical farmers. Ten quarter sections were sold bringing about \$20,000, without improvements. The best forties sold as high as \$25.25 per acre for the bare land, and the poorest for \$6 per acre. The average of 1,600 acres was \$13.32 per acre for the land only.

Kansas has again come to the front in spite of the retirement of Mary Ellen Lease. This time it is a corporation in which membership is conditional upon being in debt. It is named the Montgomery County Mortgage Relief Association. It is intended to accumulate a reserve fund by regular assessments and this fund will be used by such members as are particularly hard pressed by creditors.

Russia has a system of government banks for loaning money to farmers. They number thirty-six, all but three being restricted to specific territory. There is no competition of any kind, and the rules and regulations are carefully drawn. The last statement shows \$600,000,000 loaned on land and \$250,000,000 on buildings, in mortgages of periods varying from one to sixty years. These banks are authorized to issue bonds to ten times their capital, but never to exceed the loans on real estate made by them. They are issued at par and to a certain extent pass as currency, being frequently used to cancel mortgage obligations.

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TOPICS OF THE TIME

There are now pending be-The Bills fore the Senate and the in Congress. House of Representatives a number of bills pertaining to arid lands, reservoir sites and water supply and the preservation of the forests. One of the most important of these is the bill for the appropriation of funds to carry on the work of surveying and gauging the flow of Western streams. The question of water supply is of all others the one most important. This must be definitely ascertained and found to be adequate before there can be any security either for the capital which makes possible the building of the canals; or for the settler who tills the soil and to whom every drop of water is precious. Should Congress appropriate a half million dollars or more for this purpose it would not be out of harmony with its importance but to expect results from the expenditure of the diminutive sum of \$700 in such States as Colorado or California is The men who have this work ridiculous. in hand are energetic, intelligent engineers and every dollar which is spent in the hydrographic survey will be returned many fold in the benefits which will accrue to the Western States.

Educate the people. It is Educational an old axiom that an edu-Campaign. cated people will not be serfs or slaves. The ancient Saxon gloried in the fact that his long hair waved over the neck of a "free man." One of the needs of the American people today is an educational course in irrigation. Could they but rise to a full understanding of the benefits derived from the application of water in the proper quantity at the right time, and the possibilities of an improved industrial and economic system which radiate therefrom, the cry of hard times, of the unemployed, of suffering women and children would soon cease.

Within its scope, irrigation comprehends not alone the giving to thirsty plants a drink, but it opens avenues through which will tramp an army to reclaim and settle the vast areas of arid land, to build thereon comfortable homes; to engage in every form of industry, and to erect social institutions which as nearly as possible will place men upon an equality.

The West There has been an inclina-Must Work out its own tion in certain quarters to sit idly by and wait for Salvation. the National government to take up on an extensive scale the work of reclaiming the arid lands. While it is true that it is the duty of the federal government to undertake a large portion of this work, it is also true that until the representatives in Congress from the States east of the Mississippi can be brought to a full realization of the needs of the West it is useless to hope for much assistance from this source. But this is no reason why nothing should be done. Cannot the West work out its own salvation, even though the tools at command are not what might be desired? They will do good work if in proper hands. There are innumerable things that can be done, and when these are accomplished if a united front is presented it will be much easier to obtain a favorable reply to the requests made of the Congress at Washington.

Water Power The constant improvement in the methods of Electricity. utilizing electrical force in the numerous industries is opening a wide field for the development of the mountain regions. The vast water power which goes to waste is being harnessed and placed at work. Already in some portions of Colorado, California and Utah the tremendous fall of the mountain streams is turning water wheels and turbines, and the electric current generated is carried for miles on wires until it is finally used for turning the wheels of factories, propelling the cars on the street railways, and furnishing light and heat for homes. Through this one medium alone the development of the West will receive an impetus which will carry it forward with giant strides. Its full significance can scarcely be realized at the present time.

The Revival The wave of irrigation fever, which has swept over the Northwest. Northwest during the past few months, has resulted in the organization of numerous associations the purpose of developing and exploiting the resources of the individual States and thus inducing the immigration of a class of progressive and intelligent people. South Dakota has already put in practical operation the machinery for the carrying on of this work. Committees have been appointed and instructed to go to work immediately. Arrangements have been made to publish a large volume giving, in detail statistics and a full description of the resources of the State. The leaders of this movement are energetic men, prominent in business, professional and political circles, and they have the welfare of the State close at heart.

What will the The work to be done both before and at the Fifth Congress Do? National Congress is of the utmost importance to the irrigation cause. The cession of the arid lands to the States is not a live issue at present, but the questions of interstate and international waters, reservoir sites, the preservation of the forests are resting uneasily and some definite action should be taken. There are a number of questions relating to both State and federal irrigation legislation which must be discussed and a definite policy decided upon. It is to be hoped that the State commissions will pre-

pare full and careful reports, setting forth the needs of each particular State and some practical method of accomplishing the desired end. It is also to be hoped that little if any time will be devoted to lengthy papers on the proper methods of irrigating cabbages and topics of a similar nature. While subjects of this kind are of importance to the practical irrigator, they should not be allowed to occupy the time of the National Congress to the detriment of matters of far greater consequence. Above all, if the next Congress is to be a success it must not result in mere talk. Action, quick decisive action, is demanded, and if it is not forthcoming, the cause of irrigation and the West will be retarded instead of assisted.

Patronize The key to prosperity, whether in a town, a country, a state Industry. or a nation is, Patronize Home Industry. This doctrine is particularly applicable to the Western States. Why should Washington export lumber and import furniture made therefrom? Why should Montana export cattle and import canned and cured meats from the packing houses of Chicago, Omaha and Kansas City? Innumerable instances might be cited of the same peculiar condition of affairs and it is time that an organized movement was instituted in each State for the encouragement of local industries. Is it necessary for the people of Colorado to go outside the limits of the State for articles which can be produced advantageously at home? Why pay freight both on the raw material and the finished product? The Eastern manufacturer is merely waiting for an invitation to move nearer to the source of material supply and a market. Will he be invited?



MACHINERY AND APPLIANCES

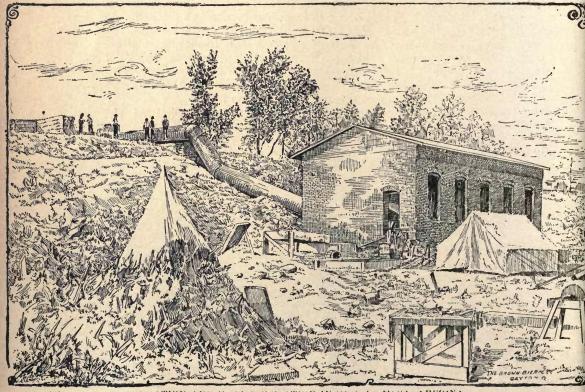
WATER POWER AND ELECTRIC PLANT.

The accompanying cut illustrates a special water power plant constructed by The Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio, for the Consolidated Canal Company, Mesa, Arizona. The water is taken from the Salt river and carried by 48-inch feed pipe across the Utah canal to a pair of 21-inch cylinder gate Victor Turbines on horizontal shaft, developing 400 h. p. under 40 feet head. One end of shaft is connected by friction clutch to a 200 h. p. dynamo which furnishes light and power for the town of Mesa, Arizona. The other end of the shaft is connected to a pumping plant for irrigating purposes. This novel plant is suggestive of further possibilities in this line.

POULTRY RAISING.

The raising of poultry for profit has long since passed the point where chance was a prime element. In these days the successful man or woman is the one who is willing to adopt improved methods. The old "Biddy," hen, has given way to the incubator, which can hatch a hundred or more eggs as easily as a dozen. The Reliable incubator has been on the market for many years, and each succeeding year has seen it improved in every particular. It gives satisfaction wherever used, because it fulfills all the claims that are made for it.

The manufacturers of these incubators have recently issued a large and handsome catalogue, which, in addition to a full description of the incubators, gives much valuable information in regard to poultry



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PUMP IRRIGATION ON THE PLAINS.

BY H. V. HINCKLEY.

(Consulting Irrigation Engineer, Topeka, Kansas.)

THE only limit to the profitable development of the billion acres embraced in the "Great American Desert" is the extent of the available water supply. The mountains and the plains afford hydrographic conditions which are entirely dissimilar. The "little farm well tilled" and watered, when compared with the bonanza wheat farming of recent years, is a step toward agricultural independence. The community in which the individual secures water from an unlimited supply under his own land is free from the control of bonded syndicates.

It is not within the province of this article to discover the various causes of financial embarrassment which have come upon many of the landed and bonded canal and water supply systems in, or originating in the mountains. The most practicable plan for the conservation of mountain waters for use in mountain parks, or on the plains in immediate proximity to the mountains, is that of mountain or cañon reservoirs with open channel or pipe conveyors, and failures of such systems to pay the anticipated revenues have not been due to the fact that they have been so constructed. Upon the prairie plains, however, natural reservoir sites or favorable damsites are scarce, evaporation reaches high maxima and artificial reservoir storage of surface run-off is, in general, impracticable.

The plains streams are generally intermittent and are often dry during the season when water is most needed for plant growth. Where the plains break geologically into high rolling lands, as in Eastern Kansas and Nebraska, storage in a small way is practicable (that is to say, in reser-

voirs smaller by far than those which are or would be built in the mountains) as by a dam, across a ravine, holding back a lake of say ten to 100 acres. Some of the valleys within these broken plains and a large area of the prairies have beneath them a never-failing water supply, moving constantly but slowly under the influence of gravity toward the sea or toward natural surface channels in which it may flow oceanward or be evaporated. This underflow is replenished by rainfall sinking through the sandy soils of the plains in general and, in the valleys, by the downward lateral flow, from natural channels, of storm waters or mountain snow waters.

It is generally conceded that to dam a plains river, like the Platte or the Arkansas, having a practically bottomless bed of sand, and to thereby hold back and divert the floods either into service canals or into side-hill or other reservoirs, is impracticable. Numerous canals have been built for the diversion from these rivers, during the flood season, of the portions of the flood represented by the carrying capacity of such canals. The general result is an annual washout of cheaply constructed head-works, an unseasonable, unreliable and, consequently, unsatisfactory service to patrons.

The writer will not say that the construction of canals upon the plains proper is in no case justifiable. Local conditions may be, and in places are, such that a canal may be an unqualified success, and such that no other service will fit them as well as that of a canal system, but the future water supply for plains irrigation will not come from the surface flow of rivers.

MONEY WASTED IN CANALS.

One of the Western Kansas canals represents over a million dollars of wasted capital, which was invested with a lack of knowledge regarding the hydrography of the region. Failing in attempts to maintain a dam for the diversion of the floods (into a canal having a capacity of only a small per cent of the flood flow) its company built a long, easy diversion dike. This failing, an attempt was made to tap the underflow by an open channel extending up stream, with lighter grade than Nature gave the river. Other companies are even now following suit, and failure awaits most of them.

The development of underground water supplies is properly a problem of engineering, not of financiering nor politics, and the man who attempts to develop the underflow by guess would go to law without a lawyer, and he must expect to be fined for contempt in Nature's court. Probably two thousand individuals in Western Kansas have erected pumping plants of various styles and capacities within a few years So far as known the rate of progress is illustrated by the following comparison of the number of plants erected: 1891, 18; 1892, 33; 1893, 55; 1894, 224; 1895, 1,241. The State Board of Irrigation reports that six of these men pronounce pump irrigation a failure. Is this strange? Irrigation is a new feature of agriculture on the It has taken the writer over two years of investigation and study to get even a fair idea as to water duty on the plains, the cost and methods of underflow development, the relative cost of pumping by various powers and other kindred problems, all of which concern every irrigator, be his farm large or small. It is wonderful, then, if only a fraction of one per cent of the farmers who have attempted pump irrigation have made mistakes sufficient to cause them to pronounce it a failure.

COMMON ERRORS.

It is so easy for a man to put in a pump for raising two thousand gallons a minute from a well that can only supply five hundred gallons a minute, and whose capacity could have been told before erecting the pump; so easy for a man to assume that with an average annual rainfall of twenty inches he will need but a very little water, forgeting or not knowing that it is the minimum of two inches in the first six months of the

year, or the minimum of five inches per annum, upon which his needs should be based; so easy for him to find in manufacturer's catalogues the indicated and actual H. P., and so think he has made all necessary allowance for friction when he buys the necessary "A. H. P." computed from the water lift; so easy for him to base his windmill computations on a fifteen-mile wind given in catalogues, when the average is but eleven, to forget the law of squares and to forget that the wind blows lightest when he needs the most water.

A FEW INSTANCES.

Let us now look at a few fair representative cases of what is being done in one season in a section of country that has been nearly depopulated on account of insufficient rainfall to produce crops.

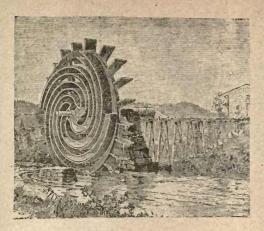
Eugene Tilleux, Tribune, Greeley Co., Kansas, uses an eight-foot mill; well 130 feet deep to water. Planted one acre of garden vegetables; three-quarters of the area was a total loss. Mill was only good for a quarter acre, and furnished not over six inches in depth of water during the season to that quarter. Besides all vegetables needed for family use, received from sale of surplus ninety dollars, which paid for the pumping outfit.

I. L. Diesem, Garden City, Finney Co., Kansas. Fourteen-foot mill; seventeen feet to water. Cost of plant, including reservoir, \$200. Irrigates twelve acres. Two acres sweet potatoes, 303 bushels; four-tenths acre onions, 400 bushels; half acre sugar-beets, 128 bushels, etc. "Have made a living this year and paid off a three hundred dollar mortgage."

J. M. Cramblett, Kinsley, Edwards Co., Kansas. Twenty-eight feet to water. Irrigates one-half acre with small windmill. Yield: 160 bushels of tomatoes, sold for \$40; four tons of cabbage, sold for \$160. Cabbage yielded at the rate of \$640 per acre. Onions and other vegetables for family use not measured.

V. Q. Billings, Kinsley, Edwards Co., Kansas. Twelve-foot mill; cost of plant \$150. Put in too late; could not irrigate till June, when crop had begun to suffer. Had several mishaps with mill and reservoir, but still sold from one and a quarter acres, potatoes, \$300; cabbage, \$100, besides family supply.

N. O. Waymire, Garfield-on-the-Arkansas, Pawnee Co., Kansas. Reservoir is filled with an eight-foot steel mill located over 200 feet away. Cylinder is a 4x12 brass-lined Morris Perfection with 7½ inch stroke. Sheet water is found at a depth of ten feet, and is drawn through a two-inch sand point. Pump is handmade, of two-inch pipe, with large air chamber and stuffing box. Conducting pipe is 1½ inch laid on the ground, and goes over the embankment with 45° elbows, forming a siphon. This makes the lift thirteen to 18 feet, according to amount of water in reservoir. Ground irrigated in 1895, with reservoir shown, was one acre subsoiled, and ¼ acre not subsoiled.



EGYPTIAN TYMPANUM.

Reservoir of 1896 is 50 feet on outside at base and five feet high. It is over two feet below the surface, will hold, when full, seven feet of water, and has nearly twice the capacity of one shown in engraving. Crops grown in 1895 were largely experimental but were satisfactory.

F. L. Richter, Garden City, Finney Co., Kansas. Seventy acres alfalfa and orchard, income seven thousand dollars.

A. L. Parson, same address. Five acres fruit

and produce, six hundred dollars.
E. E. Frizell, Larned, Pawnee Co., Kansas.
Reservoir 130 feet in diameter, banks eight feet high. Can draw out of it (at one time) over a half-million gallons, or seven acres three inches deep. Two fourteen-foot steel mills on thirty-foot towers. Ten-inch cylinders. Twenty-six-foot lift. Fill reservoir in three days on an average. Have successfully irrigated 25 acres of orchard, 20 of alfalfa, 13 of potatoes, 16 of beans, cabbage and onions. Spanish onions yield 400 to 1000 bushels per acre.*

The mistakes that have been made—the disappointments resulting from less acreages being irrigable by given plants than their owners had anticipated—have been more than balanced by the phenomenal yields under reliable water supply and thorough cultivation. The mills above mentioned are the common form of radial fan windmills on towers. Hundreds of similar cases could be cited. Suffice in a general way to say that windmills of ten to sixteen feet diameter (mostly steel mills) on towers 30 to 40 feet high are successfully irrigating from 6 to twenty acres with 20-foot lift, or 1 to 3 acres with 150 foot lift, and an investment of \$150 to \$300 is enabling the farmer to realize generally from \$20 to \$100 per acre per annum. No definite statement can be made as to average results obtainable from such investments. Intelligence and muscle are as essential as water. The man who still insists on growing wheat and corn does well

if he nets \$12 to \$15 an acre above expenses. He who grows alfalfa and feeds it nets \$20 to \$50 an acre. He who has a handy market for vegetables or has a bearing orchard or vineyard often nets \$100 to \$200 an acre and occasionally very much higher figures are given.

THE MOGUL WINDMILL.

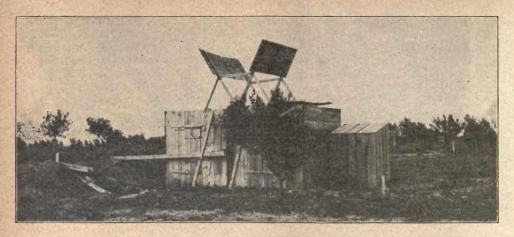
As the price paid for a pair of pants frequently depends upon the amount which the purchaser has to spend, regardless of the real economy of the purchase, so, many farmers on the plains who have trusted for years in the possibility of an increasing and more reliable rainfall, only to be disappointed, and who have lost crop after crop, and seed after seed, have been obliged to economize in the extreme in pumping plant investments and, in the absence of credit, to buy or make what they could. This has resulted in the experimental and limited use of the Mogul. This machine is generally set for a north or south wind, working equally well with either, and diminishing in power as wind veers toward east or west.

A Mogul 12 feet in diameter, 14 long, with 8 fans 2 x 14 feet, will irrigate from 1 to 2 acres with 20-feet lift. The cost, if built new and all work paid for, is from \$100 to \$200. If made by the farmer, of old stuff on hand, the cash outlay may be as low as \$25. This machine is sometimes made with fans of one board only, say 1 x 10 feet, for irrigating small garden.

D. M. Frost, President State Board of Irrigation, has on his farm at Garden City a Mogul, diameter 18 feet, shaft 12 feet, fans 3 x 10 feet. Cost \$175. Irrigates 3 acres in summer or six during the year. Also a steel tower mill, diameter 14 feet, cost \$300. Irrigates 10 acres in summer or 20 during the year. Water lift 15 feet.



PERSIAN WHEEL. From 12th Annual Report U. S. Geological Survey. Part II, Irrigation.



"MOGUL" WINDMILL. Pumping into a Reservoir at Garden City, Kansas.

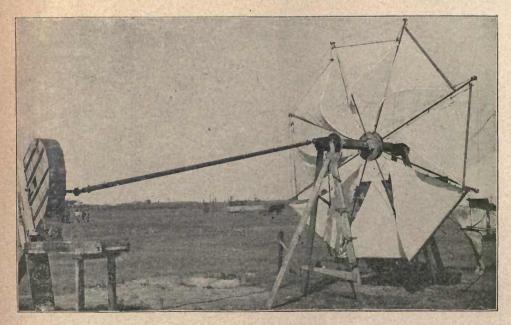
The Mogul is less reliable than the tower mill. The direction of the wind is not controlled by the irrigator and the wind is not as strong at the surface of the ground as it is 30 or 40 feet in the air.

From seventy to a hundred tower mills can be counted from the train as one passes Garden City. The windmill is the popular pumping machine; that is to say there are, on the plains, several times as many windmills on towers as there are of all other kinds of pumping powers combined because wind per se is cheap. Con-

trary to popular opinion, however, cheap wind does not necessarily furnish the cheapest power.

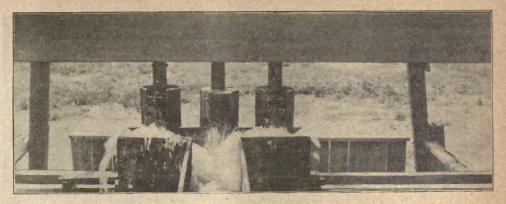
OTHER FORMS OF POWER.

Following in order of power, after the Mogul and tower windmills come the gasoline engines, driving centrifugal or auger pumps for low lifts from creeks or open wells; rotary pumps (positive) for higher lifts, or reciprocal (cylinder) pumps for very high lifts, as at the Goodland state pumping station. These plants, complete,



"DEFENDER" WINDMILL.

A sample of what inventive (?) genius is doing on the plains.



F. W. RICHTER'S PUMPING PLANT, GARDEN CITY, KANSAS.

Three ten-inch cylinder pumps being operated by one 16-foot Aermotor. Engraving shows frame of foot of tower.

cost from \$500 to \$1500 or more, though the average cost is more nearly the lower

than the higher figure.

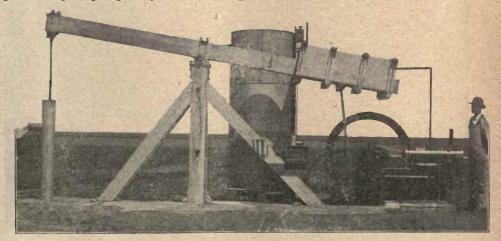
Then come the compound duplex (or high duty) steam pumping engines of usual water-works type, pumping from reservoirs or rivers. These large steam plants being expensive are not in general use, parties who could well afford the investment preferring to await the experience of others with similar plants.

A STEAM PUMPING PLANT.

Geo. M. Munger, of Eureka, Greenwood Co., Kansas, has 500 acres of orchard. He built an earth dam behind which he impounds 700 acre feet of water. He proposes to increase the storage capacity to 1600 acre feet.

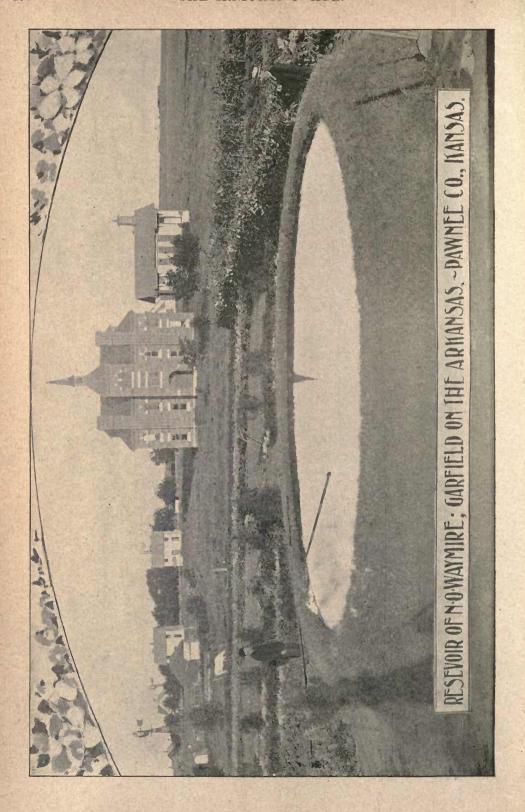
He has two boilers, each 35 H P. compound duplex pumps, capable of lifting

four million gallons a day against a lift of 49 feet above the pumps. Cost of plant to date something over \$15,000. mated cost of enlarged plant \$25,000. He says he prefers not to give publicity to his figures as to gross value of crop, profits from water investment, etc., as "these items vary so widely in practice that it would not do to publish them." However, he said to the State Board of Horticulture, very recently, "The question of whether or not it pays is the vital one to be Should a man obtain by considered. irrigation 100 bushels of corn per acre and get 15 or 20 cents per bushel for it he would not be making headway rapidly, but if a man has a bearing orchard that is yielding an occasional crop of from 50 to 100 bushels per acre of which one-half to three fourths must be classed as seconds or culls, and if by irrigating that orchard



STATE PUMPING PLANT AT GOODLAND, KANSAS.

10 Actual H. P. Gasoline Engine, operating a 51%-inch cylinder with 36 inch stroke, in a 6-inch well, 170 feet deep and raising from the underflow 6,000 gallons per hour.





A TYPICAL PRAIRIE IRRIGATION PLANT. D. M. Frost, Garden City.

he can increase the crop to three times the quantity and have it all grade fancy, it is easy to see that, at any prices for fruits that have been known to prevail, he could afford to spend a very considerable sum per acre to install an irrigation plant.

"Then if, in place of an occasional crop, the irrigation will give him regular annual crops of this class, it requires no bookkeeping to discover that it is profitable."

Gasoline has taken a notion to advance since it has come into considerable use as a pumping power. Coal sells at from four to six dollars on the plains and

the need of a cheap, reliable power for pumping offers inventive genius a prolific field. The "Defender" and the "Mogul" do not supply the need.

The wind is lightest and the sun strongest during the driest months. Who will give us a practical helimotor and reap the

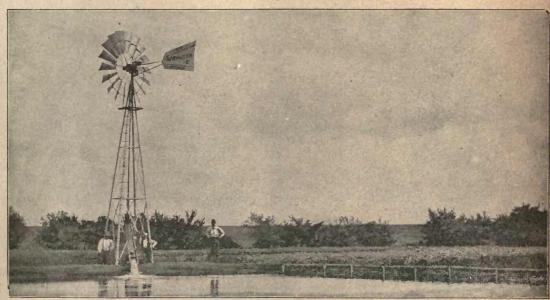
reward that awaits him?

THE AVERAGE RETURN PER ACRE.

Pump irrigation, or anything else, is a failure if it does not pay. The following table gives returns from certain crops as reported by quite a number of prominent irrigators on the Western Kansas plains. Each item, being the average of those reported to the writer, would seem to be entirely within the reach of any intelligent and industrious irrigation farmer.

	Annual Returns—Dollars Per Acre.		
Crop.	Average Bottom Land Not Irri gated.	Average Irrigated.	Best Results Irrigated, (Average.)
Alfalfa Hay and Seed.	21	36	61
Alfalfa Hay only	14	23	36
Corn	5	11	24
Wheat	7	18	29
Potatoes	25	137	250
Sweet Potatoes	25	172	333
Onions	50	275	550
Small Fruits	100	625	1,100
Orchards	50	537	1,000

Allowing for exaggerations or overenthusiasm of the honest farmers furnish-



PUMPING PLANT OF PRESTON WYCKOFF, ROME, KANSAS.

ing the data from which this table is made there is still enough margin to justify the erection of pumping plants when water is at any depth at which it is ordinarily found in abundance.

Good judgment dictates in general the cultivation of various crops on the same farm—for example early potatoes and late cabbage—thus making a given monthly supply of water do double duty. In favorable soils deep plowing and winter irrigation (storing the water in the subsoils) still further increases the duty so that all the year irrigation may be made to cover three times the acreage of ninety days' summer surface watering.

In general the larger pumping plants of either class are the more economical for reasons which it seems not necessary to

explain.

By reason generally of a saving in first cost other combinations are in occasional use: a second-hand steam thresher engine belted to centrifugal pump, animal power geared to endless chain or belt of elevator buckets or board buckets lifting in box spouts.

The whole matter of pumping water for irrigation is so new to our people that they often adopt make-shift arrangements till they can see with their own eyes what a little water does for them. How many New York farmers pay \$10 or \$20 an acre annually for fertilizers and then reap, on an average, only a half or two-thirds of a maximum crop because of a partial drought at some time during the growing period. Unreliable water by canals has been costing the average irrigator of the United States almost exactly one dollar a year per acre. Reliable water by pumps, properly planned, costs from one to three dollars in the valleys proper and as high as five or even ten dollars on the higher lands-including interest.

Where is the fruit or vegetable grower who does not, nearly every year, realize that he could well afford to pay five dollars an acre or even more, rather than to have suffered from the deficiency of water that visited him at some time during the grow-

ing season?

(To be continued.)

THE ART OF IRRIGATION.

CHAPTER XII. IRRIGATING BY FLOODING (Continued).

BY T. S. VAN DYKE.

THE size of the checks to contain the water in irrigation by flooding will also depend upon the head of water at your service.

Suppose you have two cubic feet a second, or one hundred miner's inches for ten acres. This is head enough for most any orchard work on almost any soil worth cultivating at all, and though for alfalfa much more may be used, it is quite ample if no more can be had. Suppose the checks are twenty feet square, which would give them an area of four hundred square feet. It would then take two cubic feet a second but two hundred seconds to fill one a foot deep. But you rarely want more than the equivalent of three inches of rain at a time, or one-fourth of an acre This would fill the check in fifty seconds. A line of checks to watch and let the water from one to the other as fast as filled and have no breaking away of the

water will keep you and two other average men hopping about pretty lively. And the chances are you will find any kind of waterproof boots too slow as compared with bare legs. There is no room for style in this work. It is very strict business, and often there is a very short time in which to do it. If you want to hire less help, you will make the checks larger. But here you may be limited by the nature of the crop as well as by the slope of the land. If it is an orchard it will probably be more convenient to have the ridges in the center between the trees. It is impossible to lay down any rule. The right thing is a see-saw between several extremes. In some cases it will pay to use a smaller head to avoid making too large checks, and on the contrary you may have to make them large because you are limited to so short a run that you have to use a very large head to get over the ground

within the time allowed you to run the water.

It is best to decide at the outset how much water you will put on a tract in a given time. Two cubic feet a second will cover ten acres to an average depth of three inches in about fifteen hours. On account of mistakes in printing you had better figure over for yourself all such matters, and not rely on printed figures anywhere. But you will rarely need to put on even that amount of water at once. A depth of two inches, which can be put on in about ten hours, is equal to three inches of rain, as it generally comes, and this is enough at a time for almost anything, unless the ground is very dry, or it is to be a long time before you can get water again. On a square ten-acre tract there will be about eleven hundred checks of twenty feet square, or thirty-three rows thirty-three checks long. Ten hours' run of two cubic feet a second, giving the equivalent of two inches in depth, would be six hundred minutes or but a trifle over half a minute to a check. But if as small as twenty feet, you do not turn the whole head into one check, but take them in tiers of several. A tier of six would thus give you a little over three minutes to a check. But, then, time is lost in dividing the stream and letting it from one check to the next as soon as one is filled. On the whole it is lively work, but when everything is well arranged, flooding beats the capricious clouds so much that you readily forgive it for keeping you up sometimes in the middle of the night while the man who has small streams trickling down small furrows is serenely snoring.

Checks are generally so arranged that when one is full, or nearly so, the water flows from it to the next one. Sometimes this flow will need help, and where the land is to be broken up again after irrigating they had better be made sometimes so that one will not feed the next one as there is danger of the bank cutting out too soon. How strong or high to make the bank will depend much upon the nature of the soil as well as of the crop. Where the soil is very light it is best to make the ridge so that you have to break it. This is not much of a task as you have to be there anyhow, and if the water gets away from you, a dozen men may not stop it before it has done mischief that will cost you much more labor than opening the checks.

if the ground is not to be broken up after wetting, as in alfalfa fields, then the lower ridge may sometimes be made so as to feed the next check, and so on to the end of the line, unless you feed each from the ditch direct, which is often done where the checks are large. But it is safer to cut the checks so as to discharge all water quickly. In any case the ridges, if permanent, must be made very strong and very broad at the When the roots have taken possession of the top soil a very light stand will prevent cutting of the soil and accidental breaking of the check. All trouble is, however, best avoided by a wooden gate large enough to feed properly from check to check, and it can readily be seen so as not to be in the way of driving machinery over the land. With these properly set, a breach of a well-made check is almost impossible.

MAKING THE CHECKS.

A common way of making the checks is by throwing up ridges with a plow or scraper. On some soils two plow furrows running in opposite directions, so as to throw the sod to the center, are enough for almost all temporary checks. This, of course, means very level ground, and it may be so nearly level that it is not necessary to throw the two furrows together. And some ground is so near a perfect level that one furrow will often do. Stubble is often wet in this way to prepare it for plowing, and by making the furrows only a few feet apart, land quite sloping may be well wet. This is a good enough way to prepare some ground for plowing. But in all cases where the ground is already so loose that a scraper may be used, it is best to throw up a good ridge, for with that a larger amount of water may be put into the ground with much less danger of uneven wetting.

What is probably the best scraper for this purpose can be made by any one. It is called a "ridger" and is nothing but a sled with solid board runners. These converge at one end and diverge at the other according to the ease with which the soil will scrape and the size of the ridge you are to make. One five feet long with the opening between the runners a foot or so wide at one end and three at the other will make checks strong enough on most soils to hold water five inches deep if the soil is in good cultivation to scrape. But the size of the ridger will vary with soils

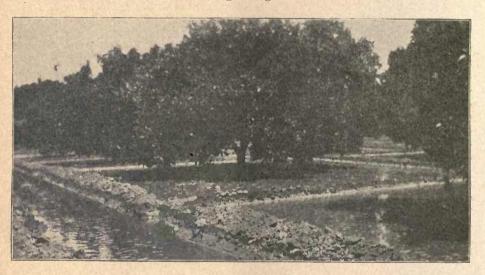
and other things, so that no general rule can be given.

If the ridger is not heavy enough with a man on it, it may be weighted with sacks of earth. When dragged over loose earth with the large opening forward, this will throw the earth to a ridge in the center behind. On rebellious ground, and often on any ground, it is advisable to have two ridgers, one larger than the other running ahead to gather earth, the other attached immediately behind to concentrate it. But to work well, this, or any other form of scraper, must have the ground in fair condition from harrowing

from either side there will be openings to be filled with the hoe. This is not as much of a task as it would seem, and for some work you may so arrange the lines according to the slope of the ground that you can use those places to let the water from one check into the one below it and thus not have to fill it so completely.

TURNING IN THE WATER.

When all is ready, the head of water is turned in and divided among as many tiers of checks as can be comfortably handled at a time. If the stream is too large for the number of checks, it will



VERY FINE FLOODING WORK.

Line of checks filled and head of water in lateral passing on to next line. Water all of uniform depth with checks filled and emptied in less than three hours. Checks made with "ridger,"

or plowing, and sometimes both. If the ground is hard or tough the plow furrows above described are about the best made available. In all cases heavy clods and big flakes will interfere with your work by letting the water through the ridges if too plenty.

Where the checks are to be permanent, as for alfalfa, they may be made well enough on many soils with the ridger. More care must of course be taken, and generally they should be rolled or dragged down into shape. A very effective scraper called the "Fresno scraper" is used in the large alfalfa fields for making these ridges, and does very perfect and rapid work. But for ordinary fields it is not necessary to buy any machinery.

When made with a ridger at each junction of a ridge with another crossing it

keep you jumping too rapidly to keep it from breaking away. If you have too many for it to fill at a time then you will do too much leaning on the hoe, and, as you generally have to hire help at this time if working much ground, you want to save time as much as anything. You will soon find the right medium by trial. Also when and in how many places to break a check so as to let the water quickly into the next one, and also how to build the lowest place in a ridge so that the water will flow out when you want it to and not before. No rules can be given for this work that are not subject to so many exceptions as to be almost worthless.

The time required to get the water over a ten-acre tract with a head of two cubic feet a second or one hundred miners' inches under four-inch pressure will vary from six to fifteen hours, according to the nature of the soil and the necessity of rushing the water over it rapidly, and also according to the number of the checks and the freedom of passage for the water through them and out of them. With larger heads you can do it in less time but will need more help, and vice versa. But slow flooding is generally bad, especially where the water stands deep, and generally all that remains in a check after doing its work is a detriment and no longer a benefit.

Sometimes checks are fed from a main at the upper side exactly as in orchard work with fine furrows. And where the checks are numerous and small this is often best, dividing the head so as to take the checks in blocks or tiers. Often it may be better to have the ditch run through the center feeding to right and left. The trouble in such case is to empty the checks fast enough without wasting the water. Where one feeds another there is little waste. The ditch must in all cases be high enough to ensure rapid and certain feed of water.

The time required to soak the ground will also vary greatly with the nature of the soil. If the checks are so made that they do not break and let out more water than you intend, the soil will be well soaked in two or three hours, and often less time after the check is covered on the bottom: If it takes much longer than this, it is pretty strong evidence that the texture of the soil is so close that fine furrows would do better for all orchard work. For in such case you are quite certain to be troubled with the soil baking too much and making it difficult to cultivate and keep the soil open with cultivation. There is also danger of scalding tender stuff in hot weather.

As the upper checks feed the lower ones and are thus full for a longer time in a long series, one would suppose that the upper side of the field will be much wetter than the lower. The same would be expected from fine furrow work. But in general no difference can be seen if the work has been well done. And it is not difficult to arrange the breaking of the checks in such way that the water will remain longer in those at the lower side. But you need not at first trouble yourself with such points, but concentrate all your talents on getting the water over the whole

as quickly as possible without having it stand too deep or too long in any one place. When once you have mastered this you will find all the rest easy enough. And if you have laid out the slope right and made the checks with care, and have plenty of help to handle the rush of water when it comes, you will find no trouble even with this.

PROTECT THE TREES AND VEGETABLES.

Flooding may be used for all sorts of vegetation. But where possible, the stalk or stem of everything should be protected from contact with the water. In the case of trees it is easy to leave a little mound about the trunk so that there is no excuse for the water touching it. But with many vegetables and small tender stuff it is generally impossible to do this at any reasonable cost. If the plants cannot in such case be set up on a little ridge above the water it should be spread over the whole in a thin sheet with the greatest speed possible. And if possible it should be done in the afternoon or evening so that the sun cannot strike the stem until it and the ground around it are comparatively dry. Plants differ much in the ability to endure the baking of the ground around the stem and the scalding of the stem from having the hot sun strike it while Young melons, for instance, are quickly hurt, while young radishes seem unaffected. As a rule the evil is exaggerated by many. Not much harm will be done anything if the water is not allowed to stay around it too long, or too hot a sun allowed to strike the stem too soon after the water is taken off. In cool, cloudy weather there is little danger. it would take you years to find out just what different things will bear in this way it is best not to risk it, but keep the water away wherever it does not cost too much in labor or money to do so.

ALFALFA AND GRAIN.

Many things such as alfalfa or grain that will stand considerable water about the stem and baking of the ground when old will not endure it when young. Certain loss will follow neglect on such things. The remedy is often simple where you can get a long run of a large head of water; and, if you cannot, you have little business trying to raise such things. It is to wet the ground so thoroughly before planting that the plants will need no more

water until old enough to shade the ground and become tough enough to endure considerable baking and scalding. The soil should be well soaked before plowing even if it takes two or more floodings to do it. Then, when in condition, it should be so well plowed and harrowed that it will retain moisture and remain mellow. Then your stuff can grow two or even three months without more irrigation and in many places will make a crop of grain without any more. But to flood it just after it is up is always to hurt it, and often to ruin most of the stand, however good it may be.

The great problem in flooding is how to make a number of checks feed each other without having the water stand too long in each, or having it run so fast through the upper ones as to cut or otherwise damage anything in it, and at the same time to use up the whole head in the series so as to have little or none to waste at the lower end.

If checks do not feed each other, then you have the expense of more laterals and gates, and more care in watching each check so as to get in just enough water to soak away quickly, and no more. If you have to have a waste ditch at the lower end to empty the check completely and see that it is done, then you might as well have one feed another at once. If you can run just the right amount into a check at once and be sure that it will soak away quickly enough to avoid scalding, or such puddling as is sure to result in bad bak-

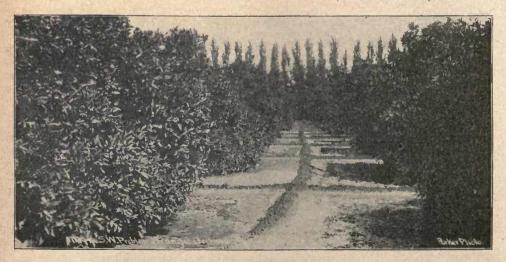
ing, even if no sun strikes it, then, everything else being equal, it is best not to have one check feed another. But it often costs more in time and labor.

Suppose, then, you are feeding a line of ten checks, one from the other. You want to have each soak an average of two inches in depth. If you let twenty inches in depth into the first one, with the view of letting it all out when it has settled down two inches, you may press down and puddle the soil too much in a very short time. Many soils, such as a fine granite soil, will rarely stand this, and in some such a depth of water will by puddling stop the soaking instead of hastening it.

You must then start with less water and run in more after you have cut the check to let it into the next one. But this involves the danger of keeping deep water too long in the first one, or else cutting the soil or injuring vegetation by running the stream over the bottom of it after it is emptied. And whichever way you try to avoid these troubles you may find yourself at the end with a large amount of waste on hand which should have gone in the ground. For you want to learn at the outset that waste hardly ever pays.

There is no royal road out of these difficulties, because each case must be decided on its own peculiar state of facts. But if you bear in mind the main principles you will soon find your way out of the woods with a little patience.

(To be continued.)



FLOODING WITH TEMPORARY CHECKS.

Checks made with ridger. Checks just emptied showing ground puddled where water stood too deep and too long-For orchard work to be followed by cultivation this does little harm if not too great, but it would greatly injure young grain or tender vegetables and destroy many of the plants.

WATER SUPPLIES FOR IRRIGATION.

CHAPTER V. STORAGE RESERVOIRS AND DAM SITES.

BY F. C. FINKLE, C. E.

M ANY of the large and important irrigation systems of the world derive their supply of water from storage or im-

pounding reservoirs.

A storage reservoir is the artificial lake bed or basin formed by closing the outlet or outlets to a valley or canyon. After the outlets are closed by means of artificial barriers called dams, water entering the valley is retained in the basin and accumulates, thus forming an artificial lake from which water can be drawn as desired. The object of storage reservoirs therefore becomes apparent, the water entering the basin at times of the year when it is not needed for irrigation, being conserved to be drawn off and used at other times when irrigation is practiced.

A storage reservoir for developing a water supply for irrigation purposes is expedient and useful only in regions where such a large proportion of the precipitation takes place during the proportion of the year, when no irrigation is practiced, as to render the natural water supply inadequate for the purpose of irrigating

when irrigation is necessary.

There are certain requirements making a storage reservoir practicable, or at times even possible. These we will now enumerate and proceed to discuss in the natural order. They are as follows:

(1.) A suitable valley or basin.

(2.) A favorable dam site.(3.) An adequate water-shed.

(4.) Proximity to irrigable lands.

It is always necessary that these requirements be all combined in such a degree as not to have the failure of an enterprise due to the absence of either one of them. At the same time it is not to be expected that they are all to be found present in a perfect state, nor even in a relative state of perfection for that matter.

The first and most necessary essential to constitute a valley or basin suitable for storage purposes is sufficient area. As will be seen later on the cost of building dams is always great so that it is necessary to have a considerable area which can be

flooded in order to make an undertaking

of water storage profitable.

Of course no fixed area can be stated as a minimum for the reason that the figure must correspond to the amount of investment required for dams. Extreme cases are sometimes encountered when small tracts of only 300 or 400 acres can be profitably utilized as storage reservoirs. This is only the case, however, when the other requirements are developed in such a marked degree as to render the cost of constructing a dam very small and the average depth of water nearly if not quite equal to the height of the dam. locality also tends to influence the question of whether a reservoir site of limited area can be profitably improved or not. The value of water varies so much in different localities that an enterprise, which would prove profitable in one place, might possess no value at all in another locality.

Next to sufficient area the most important requirement in a reservoir site is that the slope or pitch of the land included in it be light, uniform and gradual. Abrupt descent toward the dam site or steep side slopes from the middle of a valley toward either side often render it unfit for a reservoir site although it be of very large area. In order to make the flooding of a considerable area possible, where the slope is abrupt, a very high dam must be constructed, and the cost of dams increases so rapidly, in proportion to their height, as to condemn such propositions from a financial

point of view.

The value of water for irrigation purposes in the particular locality in question is also an important factor to be carefully considered as well in this connection as has already been suggested in connection with the question of area. In localities where water is very valuable a grade of seventy-five feet per mile in the reservoir site may not be objectionable, while in other localities where water is cheap a grade of twenty-five feet per mile may be sufficient to condemn a storage project.

Should the soil in a proposed reservoir

site be of such a loose and porous character as to not be capable of retaining water, but such as would allow it to sink and escape too readily from the reservoir, that would be a fatal objection. In all cases under consideration, thorough examinations should be made to determine the condition in this particular.

Another matter of importance is the liability of the reservoir to fill up with materials having a specific gravity greater than water. Such materials are usually brought down from above by heavy floods, and the checking of the current when the water charged with them reaches the reservoir causes them to settle. jection can sometimes be overcome by intercepting the materials before they reach the reservoir site or by sluicing them out after they are in. The former method is practicable when the materials are coarse, provided that a suitable place can be found in which to intercept them, and the latter when they consist of fine sand or soil and an opportunity exists for constructing scour or sluice gates for removing Materials having a less specific gravity than water cause no difficulty as they will float on the surface and escape over the waste weir.

REQUIREMENTS FOR A DAM SITE.

The conditions which make a site desirable for the construction of a dam are a narrow passage to be closed, a reasonable depth to material suitable for a foundation, good opportunity for draining the foundation, and proximity of suitable materials for constructing the dam.

All of these things materially influence the cost of a dam and in this way affect the feasibility of a project. Before any recommendation of a storage project is made, surveys and borings to determine the exact length of dam required, the depth to a foundation and the amount of water to be handled in draining the foundation should be completed. Then the class of materials required for a dam can be settled, the data already obtained enabling us to decide what type of dam to build. Next the point from which the materials for construction are to come ought to be ascertained, after which their cost can be accurately estimated.

Finally comes the estimate of the total cost of a dam based on all of the above by taking into account the contents of the foundation and section of the dam, the amount and cost of handling the material to be excavated for the foundation and the cost of cuts, tunnels or pumping water for drainage, together with the cost of finishings, gate tower, other equipments, superintendence and other incidental expenses.

SUFFICIENCY OF WATER-SHED,

In order to derive the greatest profit from a storage reservoir its tributary watershed should be capable of filling it at least once every year.

If the water-shed is limited so that the reservoir cannot with certainty be depended on to fill every year, a portion of the water has to be carried over each year, so as to ensure an ample supply for the ensuing year. In a case of this kind a large reservoir may lose a very considerable portion of its value, as the duty which it can perform will depend entirely upon how much of the reservoir will fill in years of minimum precipitation.

Thus it will appear that a large reservoir site and an easy dam site are not the only things to be sought, but that an adequate water-shed for supplying it is of quite as much importance.

An examination of the water-shed tributary to a reservoir site is therefore a matter of great moment and in the following articles we will briefly discuss the points to be investigated and the lines upon which these investigations ought to be carried out.

All of the territory draining into a reservoir site above the location of the dam is known as its tributary water-shed. To determine the area of this water-shed is the first matter of importance in investigating it.

Surveys from which the number of square miles or acres can be calculated should be made. These surveys should also be topographical in a measure, as the differences in elevation are important, so if the water-shed differs very much in elevation it should be classified accordingly. The exactness with which it is necessary to determine the area of a water-shed must be left entirely to the judgment of the engineer. Sometimes it may be so much larger or smaller than necessary that only a fair approximation of its size is required for making a report. In such cases it is usually sufficient to locate the principal points along the boundary lines of the

water-shed by a system of triangulation and then approximate the boundaries from these.

More frequently it is the case that close figuring is required to determine the sufficiency of the water-shed, in which case its area must be ascertained with great exactness. It is then necessary to traverse the boundaries with a transit line and calculate the latitudes and departures in order to check the correctness of the work and calculate the contents of the water-shed.

AMOUNT OF PRECIPITATION.

The amount of moisture falling on the tributary water-shed in the form of rain and snow should be observed and a record kept. The method of making these observations has already been discussed herein in connection with natural streams and the same rules will apply to observations on

the water-shed tributary to a proposed storage reservoir. Stations at which observations are taken should not be over a mile apart. These stations should be correctly located on the plat of the water-shed, so that a daily record of the results of each observation with the number of the station at which it was made can be kept for future reference.

The value of such observations even made for only one year is considerable, but in order to fix a minimum and maximum rainfall they should be kept for a number of years. Statistics show that dry and wet years occur in groups of from three to ten years. Hence observations must be made for a period covering half a score of years or more in order to ascertain the fluctuations of rainfall with certainty.

(To be continued.)

CASE WHERE AN INJUNCTION DID NOT LIE.

By CLESSON S. KINNEY.

SEE by the reports that my friend A. J. Chandler of Phoenix, Arizona, has finally won his case in the supreme court of that Territory by reversing the judgment of the district court. Well, he ought to have won. In the face of express statute of Arizona, and in the face of the almost universal decision of the supreme courts of the Western States and Territories upon the subject the district judge must have spent many a sleepless night in digging up an old common law theory which he thought would fit the "Water should, and by right ought to flow where it has been accustomed to flow." A theory so ancient and mildewed that it smells of the peat bogs of England, where the principal question is how to drain the water off from the land and not how to permit to run over them in such a manner that it will do the greatest good to the greatest numbers.

In the case before us, the plaintiffs and appellees were the prior appropriators and users, as between themselves and appellants, Mr. Chandler and associates, of certain water of the Salt river and conducted the same through what is known

as the "Tempe Canal" to where they used it for the purposes of irrigation, and turning a grist mill. Appellants having appropriated, and otherwise secured, the use of water from the river, subsequent to the appropriation of the appellees, at a point in the river several miles above the point of diversion of appellees, for the purpose among other things, of "creating, generating, and perpetuating, for public and private use, a water power of not less than 800 horse power," then sought to mingle the water of the appellees with their own, and run it from the river through their canal over a precipice having a fall of forty to fifty feet where their power plant was located, and afterward delivered it back to the appellees' ditch at a point above any place where the water was used by them, and at the time when this action was commenced to enjoin appellants they were so actually running and delivering said water. An injunction was issued by the district judge and upon the final hearing of the case the injunction was made perpetual, and restrained appellants from interfering with the water of the appellees, except to use it for

mechanical purposes, and provided that said water should after such use be returned by appellants to the natural channel of the river above the mouth of appellees ditch. This requirement was, of course, in strict conformity with the provisions of the common law relative to riparian rights, and upheld the doctrine that water after being used by any person to the extent permitted by common law must be returned to its original channel not perceptibly diminished in quantity and undeteriorated in quality.

The Supreme Court held that the common law had no application whatever to the use of water in Arizona. And in the case at Bar it held that an injunction would not lie at the instance of a prior appropriator of the water of a river through an irrigation ditch to restrain a subsequent appropriator further up a stream from diverting water from the river and after using it returning it into complainant's ditch, where it appears that the water is turned into such ditch above the point where it was to be used by complainant and where the complainant had the same quantity as he would have had if defendant returned the part used by him to the river.

Judge Bethune, who rendered opinion of the Supreme Court, in the course of his remarks said: "It seems to be admitted that there could be no objection to the use by a subsequent appropriator of the waters of a stream already appropriated, should the water be returned uninjured to the channel above the point of diversion of the prior appropriation. But, as we have seen, this rule springs from the common law, which, as already stated, has no application in regulating our water rights. We cannot perceive any reason why, under our system of the use of water, a person entitled to the use of a certain quantity of it should receive it at one place, instead of another, provided his rights are in no way affected or curtailed. The appellees claim a certain quantity of water for the irrigation of their lands and to run Hayden's Mill. If they get it, why should the manner in which they get it matter to them, especially when one may add useless burdens upon the exercise of absolute rights of the appellants, and either way would equally subserve the rights of appellees?

"In our view of the case, no rights of appellees are invaded by reason of the delivery of the water claimed by them into their ditch above the point of use by them. The evidence fails to show that any damage has accrued, or will accrue, to them by having their water delivered to them at the point to which appellants were delivering it at the commencement of this action, or that their remedies against appellants for a failure to so deliver the quantity of water, to which appellees are entitled, or for any damages otherwise suffered, would be in any manner different from those appellees would have should appellants be required to deliver the proper quantity back into the channel of the river. We are of the opinion that the appellants were exercising an absolute right in the use of the water, of course subject to any penalty they may incur by the use of such right. We therefore do not think this is a case for an injunction, but that the appellees have ample modes of redress at law for any damages which may be occasioned by an improper action of appellants in the use of the water, or in delivering it back to appellees. The judgment of the lower court is reversed, and the cause remanded for a new trial."

The case of appellees was simply another example of the selfishness of man. Not injured in any manner themselves they wished to prevent Mr. Chandler and his associates from using the water and thus preventing the greatest good to be done to the greatest number, and the further development of the country.

But the district judge who granted the injunction, what shall I say of him? His audacity is only equaled by the district judge of Idaho who rendered that remarkable decision upon the theory of "equitable division" of waters in the case of Hillman vs. Hardwick and others (reported in the 28 Pac. Rep., 438). In that case the evidence was that there were about eighty to 100 inches flowing in a certain stream, and the plaintiff claimed by virtue of a prior appropriation 125 inches of water. But in spite of the fact that his claim to this amount and his actual application of all of the water for the purpose of irrigation were both proven, the trial court rendered a judgment giving the defendants permission to divert something like 800 inches over and above the amount claimed

by the plaintiff. Of course the supreme court of that State reversed the judgment below, and Mr. Justice Huston, in render-

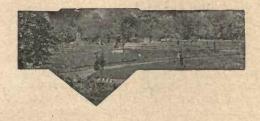
ing the opinion, said:

'We then have this anomalous condition of affairs: A creek or stream flowing 100 inches of water, with appropriations of that water to the amount of 800 inches, in addition to the prior appropriation of the plaintiff of all the water of the creek and its tributaries. To the ordinary mind this might, and perhaps does, present a somewhat difficult problem for judicial solution, unaided by the statutes, but the learned district judge found no difficulty whatever in reaching a conclusion as unique as it is unprecedented. We say unprecedented, because this question, under statutes identical with that of Idaho, has been decided so often in favor of the prior appropriator, that it has been generally considered, by both professionals and profanes, as a settled question; as, for instance, the question has been decided up to 1889, twice by the Supreme Court of the United States, seventeen times by the supreme court of California, five times by the supreme court of Colorado, six times by the supreme court of Nevada, twice by the supreme court of Montana, once by the supreme court of New Mexico, twice by the supreme court of Utah, once by the supreme court of Oregon and repeatedly by the supreme court of Idaho; in fact, the decision of the learned judge in this case stands alone. We have been unable by the most diligent search to find a precedent or parallel for it. Heroically setting aside the statute, the decisions and the evidence in the case, he assumes the role of Jupiter Pluvius, and distributes the waters of Gooseberry creek with a beneficent recklessness which makes the most successful efforts of all the rain wizards shrink into insignificance, and which would make the hearts of the ranchers on Gooseberry dance with joy if only the judicial decree could be supplemented with a little more moisture. The individual who causes two blades of grass to grow where but one grew before is held in highest emulation as a benefactor of his race. How then, shall we rank him, who, by judicial fiat alone, can cause 800 inches of water to run where Nature only put 100 inches? We veil our faces, we bow our heads before this assumption of judicial authority.

"Evidently the court assumed that Gooseberry creek was as inexhaustible as the widow's crust, or else that its decree possessed the potency of Moses' rod. All the provisions of the statute in regard to priority of right incident to priority of appropriation are ignored, as are the

sources and volume of supply."

From the rulings of these two district judges in these cases it is evident that in some parts of the West all do not understand the arid region doctrine of the appropriation of waters. The rights of the first appropriator must be respected. But water is too precious an article in this part of the country to be permitted to run to waste, or to prevent its use to its fullest capacity. The great weight of modern authorities hold that where a person has diverted a certain portion of the waters of a stream and permits a part of the water so diverted to run to waste, or fails within a reasonable time to use a certain portion of the water for some beneficial use or purpose, he can only hold that part of the water diverted which has been actually applied to some beneficial use, and his priority extends only to the quantity so used. Also the authorities hold that in such a case there has been no appropriation as to the water not used and which ran to waste, but that that part might be subsequently appropriated and held by other parties, provided they took the proper steps, and they, themselves, applied it to some beneficial use or purpose. final test in all cases is, whether or not all of the water diverted is actually applied to some useful or beneficial purpose.



CORN AND ITS CULTIVATION.*

BY H. R. HILTON.

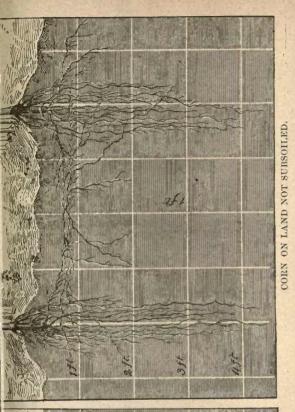
IF we have fairly ascertained the habit of growth of the corn plant and the conditions most favorable to its best development, we can more intelligently adopt methods of cultivation that will most nearly supply these conditions. studies so far made in corn roots suggest that the food gatherers love a finely-pulverized soil well supplied with humus, in the zone from the third to the tenth inch in depth from the surface. In valley soils containing sand this zone may be increased to 12 to 16 inches in depth. As the surface roots or food gatherers do their principal work in the first 40 days of growth, we are led to doubt whether all the essential conditions can be supplied by listing old corn ground each spring, and preparing the soil for root growth while the plant is growing. This method involves heavy root pruning, or, in avoiding this, leaves a small area of pulverized soil for the feeding roots to work in.

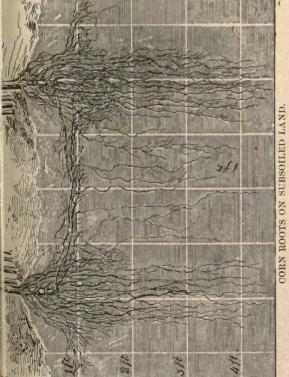
Assuming that all obstruction to free entrance of water into the subsoil by use of a subsoil plow (if such obstruction existed) has been removed, I would favor fall plowing, about 8 inches deep, turning under a green catch-crop of cow-peas, soybeans, Kaffir corn, or sorghum. If the implement is not specially designed for pressing the soil around the vegetable matter turned under to gather the moisture and start it rotting, follow the plow promptly with a disk harrow, and the disk with a drill that admits of the shoe being elevated so as to allow the wheels to sink down into the loosened soil to the greatest depth possible and pack the lower soil while leaving the top soil loose. The harrow should be passed over the ground after every heavy rain till winter sets in, to keep the top soil dry and prevent baking of the surface soil and evaporation of the water. In the spring open lister furrow, keeping, if possible, above the layer of green manure turned under the previous fall.

In order to get as much of the butt end of the stalk below the level of the ground as possible so that more joints may be covered and more circle roots developed, care must be taken not to let any loose irt roll into the furrow till after the plant appears, as the first roots which form the base of the stalk develop as near the surface as they can find moisture after the first green leaf appears. Hence the farther below the level of the ground the first leaf comes through the soil, the longer will be the section of the stalk below the surface and the greater the number of roots

that can be developed.

As the plant grows in the lister furrow only the finest soil should be allowed to sift in around it, till the ground is all brought to a level, to facilitate the development of new roots as new joints are formed in the stalk and covered by the soil. If the soil is very fine textured and warms up slowly in the spring, or if the planting is done very early in the season, then a deep cultivation of the hill between the rows may be helpful in warming the soil to a greater depth, so as to make more favorable conditions for root growth at a greater depth, and prevent the first roots from coming so close to the surface early in the season, within the range of the cultivator tooth. After the plant is six inches high, and the soil warm enough for root growth to a depth of one foot, the cultivation should not exceed three inches in depth, and should all be for the purpose of drying out the top soil to conserve the moisture. With many the object of cultivation is simply to destroy weeds, but if the ground is promptly cultivated after every rain there will be no weeds, as small weeds cannot develop when the top soil is kept dry for two inches in depth. In wet seasons large cultivators may be needed to destroy weeds, but for dry-soil mulching a small-toothed cultivator, or one with narrow spring teeth, the points set well forward, so as to cut the top soil clean from the soil below, and to run shallower beside the corn row than in the middle of the furrow, will usually mulch the soil best. The forward reach of the spring tooth brings the clods and coarsest material to the surface, and sifts the finest soil underneath, lessening danger of loss by the wind, and leaving the surface roughened, so as to break the force of heavy rain-drops that tend to compact the surface, a condition favorable to baking as it dries out.





The rule with a majority of farmers is to cultivate four times and quit. One good rain after corn is "laid by," if followed by dry weather, will do more harm to the crop, on a fine-textured soil, than if no rain at all had fallen after the last cultivation. The plant needs its greatest supply of moisture at the time of blooming, and to insure favorable conditions shallow cultivation, with single-horse, fiveor 12-tooth cultivators, or an "A" harrow, is essential till the crop is practically made. Late cultivation makes a fine seed bed for winter wheat to follow corn, and take up the nitrogen made available too late in the season to be taken by the corn plant and in danger of being wasted. If a wheat crop is not desired, sow rye for this purpose, and plow under in the

spring.

Figure 2 shows the root of a corn plant uncovered in 1895 on Scott Kelsey's farm. in the Kaw valley, Kansas, just east of Topeka, grown in the track of a tree-digger that, in taking up nursery stock in the fall of 1894, had pulverized the soil 18 inches deep and 20 inches wide. track of the tree-digger in its width and depth was a mass of fibrous roots. In the zone between the tree-digger furrows, where the ground was hard, there were few fibrous roots, and a limited number of large, smooth roots. This field yielded 84 bushels per acre in the season of 1895. The subsoil roots were followed 41 feet down, but the ends were not found. By way of contrast, see Fig. 3, on upland, four miles north of Topeka, never plowed over six inches deep. All the fibrous roots (food gatherers) were found in the lower two inches of the cultivated soil. A cultivator tooth running four inches deep would leave only two inches in depth of cultivated soil for the food gatherers to work in between the rows-entirely too limited an area to secure good results. The root development was small, and only two joints were covered sufficiently to send down subsoil roots. The yield was under 40 bushels per acre.

As corn roots use the water in the soil to a depth of five feet at least, this would give 25 cubic feet of soil for each plant to root in, and, when fairly moist, would contain about 20 gallons of water, available for the use of the plant. This would be more than two-thirds of the quantity needed to make a 60-bushel-per-acre crop, and

equivalent to a rainfall of nine inches. How much the plant gets depends on the cultivation given the soil to check evaporation. On a majority of Kansas farms all corn-stalks in excess of 8,000 per acre are weeds, robbing the 8,000 plants of the moisture they so much need to perfect the grain. If one stalk in five square feet of ground can not perfect the seed, how much less likely are two stalks occupying the same territory to do so? Every surplus plant is a "dog in the manger," that can not bear fruit itself and prevents its neighbor from doing so by stealing its moisture. Seed corn should be selected from the

stalks that have shown best adaptability to their environment and best withstood adverse conditions. This selection should be made when the ear is ripening, and stalks marked by tying a red tag on each one. When corn is ripe these marked ears can be picked and put away for seed.

Study the growth of roots and soil conditions where the best corn-stalk on the farm grows; also the roots and soil where the poorest corn grows. A comparison will help to a better knowledge of what the corn plant needs and to better methods of cultivation.

THE ELECTRIC PLOW IN GERMANY.

BY W. C. FITZSIMMONS.

IN the October Consular Reports, Mr. Otto Doederlein, United States consul at Leipsic, Germany, gave a most interesting account of the practical operations of a plow propelled by electrical power, and

giving great satisfaction.

The details cannot be here given, but it may be stated that electricity as a practical feature in the most important of all farm work, that of hauling the plow, is fully established. To show this it is only necessary to give the final figures of cost as compared with that of plowing by means of animal power and steam. Assuming that the farmer has a ten-horse power threshing engine to run the dynamo, the cost of plowing an acre of land to a depth of 9.24 inches is given at \$1.29 per acre, as against \$2.74, the cost of doing the work with oxen. Under favorable conditions the expense could be reduced to \$1.14 per acre. In all cases it was less than one-half that of doing similar work with oxen.

It was also found that, as compared with plowing by steam, the cost by electricity was less than half. Whether for work on a large or small farm the Germans have found electricity much the cheaper motive power for the plow. In this connection we quote the words of the consul as follows:

"It is thus evident that the working expenses of the electric plow for extensive husbandry amount to less than half of those incurred in working the steam plow. This contrast is readily explained, for the capital sunk in the plant is only one-third of that required for the steam plow; the expenses connected with the generating of power are materially lower than is the case with the steam plow, in which a very considerable surplus power has to be raised in order to work the pulleys and brakes and to overcome the stiffness of the rope.

"I have been informed by the director of the Haale factory that electricity will shortly be also used in digging potatoes

and sugar beets."

Right here is an opportunity for Western manufacturers as well as for those interested in the development of electrical power. We have almost unlimited water power in the arid States in the mountain streams which can be and at no distant day will be utilized for hauling plows and doing other farm and ranch work on our great plains and in our fertile valleys.

The door to an immense industrial development stands wide open before our men of capital and enterprise. Will they

enter and reap the rich rewards?

THE DIVERSIFIED EADA

THE GENTLEMAN-FARMER.

BY F. C. BARKER, OF NEW MEXICO.

NEARLY every one knows what is meant by the term gentleman-farmer, although the meaning is somewhat difficult to define; for the fact is there are many kinds of gentleman-farmers. In the first place we have the gentleman who is farming for pleasure only. So long as he is content with the pleasures to be derived from the occupations of a rural life, he is likely not only to be satisfied with himself, but his neighbors will benefit from the many experiments which gentleman-farmers are prone to indulge in. Such men are the most useful members of an agricultural community.

There are, however, other classes, of whom we have unfortunately too many specimens in the irrigated districts of the We have the gentleman-farmer who wishes to combine pleasure with profit too often lured on by the roseate hues of the boom literature of this new country.

Now I am by no means deprecating the idea of deriving pleasure from one's business, indeed I can hardly imagine the successful man who does not do so. But far too many men are anxious to engage in agriculture or horticulture without having the previous experience which will enable them to form any idea of whether such a life is likely to prove pleasurable or otherwise. When such men find that life on a farm is not a continuous round of pleasure, but that there are many difficulties to be overcome, disappointments to be borne and hard work to be done, they are apt to be soon discouraged.

The fact is that the successful farmer has longer hours to work and harder work to do than falls to the lot of almost any other man, and this holds good on the irrigated farm perhaps quite as much as where the advantages of irrigation are absent. The farmer, however, has this advantage over most other men. He can perform his work cheerfully knowing that he is not working for any other man, but that the whole produce of his labor will be enjoyed by himself or by those he loves.

His is an independent life and he is not at the beck and call of any boss or at the mercy of any capricious customer. Every evening he has the pleasing satisfaction of feeling that he has accomplished something of which he himself will see the result and reap the benefit. He knows that good work will bring him not only financial success, but, that which man esteems above money, the approbation of his neighbors. Thus the good farmer gets to take a pride in his work, and what to others may be merely toil is to him a pleasure. I fear that very few of our gentlemen-farmers look upon the matter in this light, but when they do not, farming is likely to prove a curse to them and they a curse to farming.

Lastly we have the gentleman-farmer who expects to spend the money while the other fellow does the work. This class is especially numerous on irrigated farms. Call at his farm and ten to one you find him absent. Either he is on a hunting expedition, or he has gone for the mail or is in town on some small shopping errand that might well have been left to his wife. If by chance you find him at home he is either reading the daily papers or smoking a cigar on the piazza. The last thing he ever thinks of is to take off his coat and go to work with his hired men. keeps a cow, a hired man does the milking and a hired girl makes the butter. If he has a vegetable garden, the hired man does the hoeing and digging. No wonder he tells you that he can buy butter and vegetables cheaper than he can raise them and that pigs don't pay.

He who expects to lead a "sweet do nothing" life as a farmer is apt to have his castle of indolence rudely shaken to its very foundations. It is of course possible to make money on a farm where the labor is done by hired help, but the farmer himself will have to work as hard as any of his laborers. The hired man does not as a rule feel any pleasure or take any pride in his work. He will need constant watching, and the farmer who not only watches his laborers, but sets them the example of good work is as a rule the suc-

cessful farmer.

COST OF RAISING CORN IN KANSAS.

K ANSAS is certainly a great corn State. Statistics show that the average annual yield for all the thirty-four years, bad seasons and good, since 1861 has been twenty-seven bushels per acre for the entire State, ranging in different years from 9 to 48½ bushels. The product for twenty-five years ending with 1895 has had an annual home value averaging more than \$31,000,000 and a total value in that time exceeding \$776,000,000.

Secretary Coburn, in the March quarterly report of the State Board of Agriculture, presents a detailed showing from 68 long-time extensive growers, in 45 counties which last year produced 140,000,000 bushels, giving from their experience "on such a basis as others can safely accept" each principal item of cost in growing and cribbing an acre of corn, estimating the yield at 40 bushels. About two-thirds of those reporting prefer planting with listers and the others use the better known checkrow method, after the land has been plowed and harrowed.

The statements of all the growers summed up, averaged and itemized show as follows:

COST OF RAISING AN ACRE OF CORN.

Seed\$	0.07
Planting (with lister, or with check-row	
planter including cost of previous	
plowing and harrowing)	.77
Cultivating	1.03
Husking and putting in crib	1.18
Wear and tear and interest on cost of	
tools	.25
Rent of land (or interest on its value)	2.41
	- 10
Total cost \$	5.71
Cost per bushel	.144
Average value of corn land per	
acre\$2	29.25

The condensed showing made by the 43 growers who plant with listers, or have found that method preferable, is thus:

Seed	. \$0.07
Listing	44
Cultivating	. 1.06
Husking and putting in crib	. 1.16
Wear and tear and interest on cost o	f
tools	25
Rent of land (or interest on its value)	. 2.44
Total cost	\$5 42

Statements of cost, where the land is plowed, well harrowed, and planted with the ordinary check-row machine, summarize for each item as follows:

Seed	\$0.07
Plowing	1.03
Harrowing	.24
Planting	.25
Cultivating	
Husking and putting in crib	
Wear and tear and interest on cost of	
tools	.30
Rent of land (or interest on its value)	2.35
Total cost	\$6.40
Cost per bushel	16

Commenting on these figures Secretary Coburn says: "In none of these calculations has there been made any allowance for the value of the corn-stalks, which ordinarily, under the crudest management, should offset the cost of harvesting the grain, and under proper conditions should have a forage value much in excess of such cost. Taking these into every estimate, as should rightly be done, the showing of cost per bushel would be very sensibly diminished. In the results of this investigation it will likewise be noted that the rental for these Kansas corn lands, or the interest figured by their owners on the investment represented, averages more than 84 per cent. or a net rate higher than the capitalist, general banker or money-lender dreams of realiz-

Further, it should be understood that the thrifty Kansas farmer does not measure the profit of his crop by the narrow margin shown in such statistics between the items of 'cost' and 'value.' He does not, as a rule, anticipate selling his corn by the bushel at the figures given as 'value,' nor expect more if he did so than a moderate return, one year with another, for his labor and investment; it is the conversion of it, on his farm, into beef, pork, poultry, dairy and similar products from which comes the surplus to make the comfortable homes and build the school-houses, colleges and churches that are such common objects on his horizon and so largely the measure of his

ambition."

CALIFORNIA LEMON GROWING.

THE Azusa Pomotropic has the following interesting and instructive article on lemon culture:

"A large number of our readers are engaged in lemon culture, therefore will read with interest anything that bears upon that industry in this locality. It seems strange that the forecasts

of extremely low prices early this spring are not being verified. Scarcely any one believed there would be much sale for the fruit at remunerative prices till July or August. Advices from the East have predicted the usual depression in the lemon market, but we notice both the lemon companies at Azusa keep busy reand dispatching the ceiving Furthermore, we are informed that the demand is brisk and the supply inadequate and that good prices are prevailing. No one doubts that the better care in growing, picking and curing has much to do with better markets, for the trade is learning that it is getting less and less precarious to order California lemons in large quantities and that they can be supplied in satisfactory quantities from

"Before experience taught our growers, they did not suppose that a warty or ridgy lemon was more subject to decay than a smooth lemon of exactly the same internal texture. Now they know it is next to impossible to preserve the oil glands in the rough lemon during the picking and curing period. Experience has shown that a smooth lemon properly matured, gathered and cured escapes injury much more thoroughly than a rough one of the same class otherwise. By observing common sense methods, the California growers are putting forth a grade that the trade is getting to rely upon and firmer prices are maintaining wherever the fruit has been tried.

"An examination of the lemons now curing in the association packing house at Glendora shows a very large majority of them grown with smooth skins, and invariably they stand the curing ordeal better than the corrugated and lumpy fruit of the same general quality. Scott, the manager, attributes the production of finer fruit to closer soil assimilation, greater age in the trees and common sense pruning, with great emphasis on the latter clause. 'Put on the tariff and lop off the water sprouts,' might be nailed to Scott's office door as the theme of his daily discourse, varied with reflections on ripe-lemon pulling, carelessness in handling, over-irrigation and-lopping off the water sprouts again.

"Since his advent at Glendora he has interrogated every sentence with a pruning hook. He believes in his theme-

it may prove to be a mission to this valley, where lemon trees grow like eucalyptus-and he stays with it every day in the week. It is well to have a monitor in the association for it cannot select the good and refuse the bad that comes to a lemon curing establishment, and its success is dependent in a good measure on securing as little poor fruit as possible, for its members have a right to have their entire output cared for. Agitation for better methods should be the association's watchword and is, and while Mr. Scott's theories on pruning are most radical they are rational and are producing results to be proud of in their application."

Feeding Cattle.-L. L. Roy, of Topeka, Kan., has recently made a careful test in feeding flaxseed meal to twelve rough cattle. They weighed when bought 10,340 pounds. In seventy-five days they gained 4,610 lbs. The shrinkage before sale on the market was 710 lbs., partly due to bad handling. The ground meal cost about one third more per ton than corn. The cattle were in such prime condition that they brought 40 cents per hundred more than other cattle of the same weight sold the same day. The summary as made in Colman's Rural World shows:

This very valuable feeding test established beyond question several new points in feeding, and strongly emphasized some others. Among them are the facts that ground linseed meal

Makes meat quickly.

Makes meat at less money than otherfeed. Makes more meat than other feeds.

Makes absolutely healthy meat, which is worth much in the steer or hog, and worth infinitely more to the person who eats it.

Makes a loose hide, a good digestion and the best possible general appearance.

Makes meat that sells for more money than animals fed on other feeds.

You can feed without danger, as much of it as the animal will eat. The more you feed the more meat you get.

Do not be afraid to feed it liberally. It

is feed, and not medicine.

It contains three times as much nourishment as corn, and does not cost much more than corn. Therefore, it is cheaper than corn.

MAXIMS FOR THE IRRIGATED FARM

Push your work; never let it push you. It is the early spraying that will prevent the worm.

There is never lack of demand for the best butter.

Theory and practice must go together in good farming.

Potatoes must have loose earth in which

tubers may expand.

There is greater explosive power in an idea than in a bomb.

Read critically. There is much written that is not Scripture.

You cannot compete in butter making these days with poor cows.

It is easier to keep out than to drive out insect pests from the orchard.

Good horses command the best prices even though less than formerly.

Stick to the crop that pays you well, to what you are successful in doing.

If a cow's attention is attracted she

immediately lets down her milk.

It is better to coax than to beat a nerv-

ous cow. You will get more milk. A boy should be educated to make a

farmer as much as to make a doctor.

Business principles are just as impor-

tant to the farmer as to the merchant.

Whatever you do if done well stays

done and saves time, trouble and worry.

Turning under green crops is one of the cheapest and best methods of fertilizing.

Even bacteria have their uses. You cannot make cheese without their assistance.

Co-operative enterprises need good management, or they will fail as others do.

Be careful in the selection of seeds. It will improve the crop and increase the profits.

It is necessary to mature your lambs for the market, as well as to give them growth.

A chief advantage in dairying for the farmer is, that it causes no depletion of

The reading farmer may profit by the experience of others, and it contributes to his success.

Never rush the cows from pasture to stable, and never set a dog on them. It means money loss.

Free discussion of methods among neighbors will improve the general neighborhood conditions.

Feed your strawberry beds early and well, and they will give you bounteous return of luscious fruit.

Ensilage is not only nutritious but appetizing. The silo is an excellent provision in the farm equipment.

It is the duty of the farmer to live better than anybody. He has only to improve his opportunities.

A man need not work himself to death because he is a farmer. Mind may do a share as well as muscle.

A horse is more liable to scare with than without blinders. He is seldom afraid of what he can fairly see.

Not all knowledge is gained from books. With an open eye and mind the man at work will get a good education.

Do not use too much water. Your thirst may be satisfied without drowning you. It is the same with a plant.

The meannesses of human nature are a bar to co-operative effort. There is too much pig nature in the combinations.

Nothing pays better on the farm than to keep accurate accounts—to know what is raised at a loss and what yields profit.

Be sure to get the bulletins from the agricultural experiment stations. They are doing important work. Keep in touch with it.

Governments are too apt to be great machines for robbing and oppressing the people. If ours is so used it is the people's own fault.

Be careful in selection when buying trees. One variety will bring profit, another will cause you loss. Foresight is better than hindsight.

Don't waste the straw. It may not be as nutritious as good hay, but it contains enough food and fertilizing properties to be well worth husbanding.

Never forget the duty of the good citizen to vote. You cannot have success without good government; you cannot have good government unless each man contributes his share toward putting the best men at the helm.

PULSE OF THE IRRIGATION INDUSTRY

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PRACTICAL CO-OPERATION.

THE Owyhee Canal in Malheur county, Oregon, is an example of what can be accomplished by practical co-operation among farmers.

The canal is twenty-five miles long and carries 20,000 inches of water. It is twenty-two feet wide at headgate, twenty feet wide on bottom for first ten miles, and cost \$100,000. It covers 25,000 acres of land, all of which has been located, and

of the company payable in eighteen months, the stockholders accepting the notes in payment for work the same as they did stock, thus enabling the company to complete the canal and turn the water in for irrigation.

The property was then bonded for \$50,-000 and the notes redeemed with proceeds

from sale of the bonds.

The canal is now substantially built throughout its entire length, all fluming being avoided, and every dollar spent in



THE OWYHEE CANAL IN OREGON.

the locaters of these lands are the owners of the capital stock of the company.

The capital stock of the company is \$100,000, divided into 10,000 shares of the par value of \$10 each, 8,600 shares of which have been subscribed by, and are in the hands of actual settlers under the canal, and on which about \$6 per share have been paid into the treasury of the company in labor on construction of the canal. The excess of cost above amount obtained from subscriptions to the capital stock (about \$50,000) was raised by notes

its construction was represented in honest work by the owners and their teams. The company has never had any money, and this great canal simply represents what men with honest hearts and willing hands can do. After they had exhausted their own resources they took the company's (virtually their own) notes which resident merchants magnanimously accepted in payment for supplies, and this enabled them to complete the work.

The Owyhee river is a perennial stream which perpetually flows a much larger

volume of water than the canal is able to carry. From this stream, at the mouth of a rocky canyon through which it flows for sixty miles above, the water for this canal is taken and no ditch can ever be taken out above it. Thus the complications arising from conflicting rights to the waters of this river will forever be avoided.

This enterprise was undertaken a few years ago when the farmers of Eastern Oregon realized that irrigation was necessary. Under the able management of Mr. T. T. Danilson of the K. S. D. Fruit Land Company the work was rapidly pushed forward in spite of the fact that many of the farmers were discouraged and failure seemed imminent. Mr. Danilson had great faith in the ultimate outcome of the enterprise, and for months the farmers who were building the ditch obtained their supplies from his general store in Ontario, paying for the greater part of the same in work.

This canal is at the present time furnishing an abundant supply of water for the farms and orchards adjacent, and its one great feature is that every owner of an acre of land watered by it is a stockholder and has a voice in the management of the canal company.

IRRIGATION IN WESTERN CANADA.

BY A. H. FORD.

IRRIGATION is taking thousands of settlers along the line of the Canadian Pacific Railway. The Canadian government has recognized the value of a constant supply of water for the farmer and has issued a volume descriptive of the work already accomplished.

It is because of its remorseless energy in promoting every practical reform of real interest and use to the farmer that the Canadian Pacific railway successfully draws settlers from not only Europe, but from our own prairie States. An example is set which should not be fought by legislation adverse to the great system of railway, across the border, but which should be emulated by our own government and railroads.

The Canadian Pacific railroad is determined to make the territory through which it passes known to the world as a cultivated garden 4,000 miles long and several hundred wide. No expense seems

to be spared to improve the fertile fields through which the great lines of iron run.

The Canadian Pacific railroad stretches across the continent and is striving to become the highway of travel and traffic between England and Japan, with facilities for the tourist, who can sail from Liverpool in a Canadian Pacific steamship and never leave the care of the company until he islanded in China.

Selfish motives may govern this great corporation, but if it will assist in the irrigation of its territory and make the great Northwest even a greater garden spot than it is, no one should find fault if the railroad is also a gainer, and many American railroads would do well to study a system which will convince settlers that they will be treated as friends of the transportation company near whose line they locate.

The people of British Columbia and Alberta have learned that irrigation doubles crops even where there is abundant rainfall, and vast tracts of formerly arid land in this region are being opened up by irrigation and proving to be the richest lands in the world.

The eyes of the home seeker will be turned to the Northwest as long as the Canadian government and the Canadian Pacific railway make the prosperity of the farmer a part of their business.

A MONTANA CONVENTION.

A T the Montana Mining and Immigration Convention held in Helena a month ago the resources of the entire State were taken up and ably discussed by a number of the leading men who were present. An invitation was extended to those in the over-crowded portions of our own country to assist in developing Montana which with the vast area of 146,000 square miles has a population of about 185,000.

J. C. Auld, of Glendive, secretary of the Arid Land commission, stated that irrigation would be the greatest source of power and riches. In the smaller valleys of Montana the question would naturally solve itself, as the land was fertile and the water supply ample and easily obtainable. Individual or co-operative ditches could be built with a limited amount of capital. In a general way Mr. Auld stated that it



THE LATE GOVERNOR JOHN E. JONES, OF NEVADA.

was possible to construct reservoirs by building dams across coulees or ravines, and thus impound large bodies of water capable of irrigating immense areas of land. The water now going to waste in the larger rivers, the Missouri and the Yellowstone, as well as their tributaries, the Sun, Milk, Big Horn, Tongue and many others, was simply enormous.

Other speakers were Governor J. E. Rickards, Prof. S. M. Emery, of the Experiment Station at Bozeman, Jerry Collins, Jas. M. Mills, commissioner of the bureau of labor, E. Larssen, Chas. S. Fee, General Passenger Agent of the Northern Pacific, J. K. Foote, T. E. Collins, D. R. McGinniss, Moses Folsom, of the Great Northern Railway, Judge Strevell and C. R. Middleton.

THE DEATH OF GOVERNOR JONES.

IN the death of Governor John E. Jones, of Nevada, not only the State but the entire West has lost a true friend and an honest and faithful worker for its best interests. Governor Jones was an ardent advocate of irrigation, and probably to his efforts more than those of any other individual is due the firm foundation which has been laid for the future development of the State of Nevada. It is impossible

at this time to correctly estimate the value of Governor Jones' work, or to befittingly express the sense of loss at his untimely decease.

FOURTH NATIONAL CONGRESS REPORT.

I HAVE frequent applications for copies of the Proceedings of the Fourth National Irrigation Congress, held at Albuquerque, New Mexico, September, 1895, but am compelled to refuse all applicants, because the proceedings of the congress

have never been published.

A word of explanation at this point is due to the members of the congress and is also due as a matter of justice to the members of the National Executive Committee of 1895. The proceedings of all previous congresses have been published by the Convention cities. The National Committee has no funds for such publication. No assessment was ever made on delegates to the congress, and the expenses of the meetings, usually from \$3,000 to \$4,000, have always been borne by the city in which the congress met. The citizens of Albuquerque and New Mexico spent a large sum of money in advertising the congress, in providing a place of meeting, in badges, program, etc., and probably do not feel justified now in expending an additional \$500 to \$800 in printing the proceedings.

The local press at Albuquerque, though hampered by limited facilities and hindered by the existence of the Territorial Fair during the same week, gave most excellent reports of the proceedings of the congress, printing much of the discussion and many of the papers in full, so that the delegates, by saving the local papers, were all able to take home with them reasonably complete reports of the

meeting.

I have made this explanation thus lengthy and in detail in order to silence, if possible, the criticism which seems to exist in some quarters against the old Executive Committee for not publishing the proceedings of the Albuquerque Congress, for it is a matter with which the Committee has had nothing whatever to do.

FRED L. Alles,

Los Angeles, Cal.

Secretary Fourth National Irrigation Congress.

HOW ONE WOMAN FIGHTS THE DROUGHT.

One of the farmers of large areas in Kansas is Miss Mary Best, of Medicine Lodge, says the Kansas Farmer. English by birth, she naturally cast her eyes over the Queen's dominions, when the trouble with the dry weather came on, to see if anywhere under the government on whose lands the sun never sets a remedy for drought had been found. Yes, in India irrigation is old and irrigation is new. Millions have recently been invested in its development. The subject was thoroughly studied and the first practical result on Miss Best's farm was the reconstruction of an old dam in the Medicine river. The next was the construction of a number of Jumbo windmills and home-made pumps. Water was turned on during the winter. A large tract was kept flooded about a foot deep for several days. After the spring opened it was a long time before this flooded land got dry enough to Sixty acres of it were finally listed This land was rather too wet to cultivate easily, but the corn prospered. The lashing of the hot winds did not affect it. Those winds did, however. drive the "Jumbos" at a furious rate and lifted great quantities of water.

Miss Best's farming is considerably diversified. With her present knowledge of how to fight the drought it will be

sure in its results and profitable.

MINES AND MINING OUTPUT.

It is claimed that the mines of Idaho have added \$300,000,000 to the wealth of the world.

It is estimated that 10,000 people will go into the Yukon country this spring, and steamer loads are going from all the Pacific coast ports.

THE Hematite mining district in Northern New Mexico is attracting attention, and they are claiming it to be the Cripple Creek of that section.

THERE is a considerable development of gold mining in the Cache valley, Utah, where good finds are being made and considerable work is in progress.

THERE is a steady cheapening of the cyanide process, and within a brief time it

is thought it will be possible to treat four and five dollar ore successfully and profitably.

THE Flagler smelter, at Silver City, New Mexico, which has been a long time idle, has been started again under vigorous management, and has ore in sight for a long and profitable run.

It is reported from Bakersfield, Cal., that a very rich discovery of gold quartz has been found in the desert region southeast from there. Experts pronounce the mines very rich, and a rush of miners has set in.

THERE is unusual activity in the Elizabethtown mining district of Northern New Mexico. It is an old camp and has yielded a large amount of gold in the past. It seems to be improving with development.

A Town SITE outfit, said to be backed by the Santa Fe road, started from Trinidad recently for the Baldy mining district, and a branch line is said to be talked about to leave the main line near Maxwell City, New Mexico.

ALL the mining districts of Arizona claim to be sharing in the general prosperity of the industry. The resumption of work on old properties, the discovery of new ones, and important strikes in every direction, is the rule throughout the Territory.

THERE is intense activity in all the mining districts of Utah, both in the gold and silver districts. It has been possible to operate the silver mines of this State profitably despite the heavy decline in the price of that metal. The chief public interest centers about the Mercur district where the adoption of the cyanide process is rendering the mining of low grade gold ores exceedingly remunerative and with a comparatively small investment for the necessary plants. The ore bodies are being found over a wide area and in immense deposits.

It is fortunate for Cripple Creek that the wholesale business of organizing and floating wild-cat mines has met a check, even though it may throw some measure of discredit upon the legitimate and wellmanaged properties temporarily. The great number of strikes that are being reported from all parts of the district, and more than all the vast output of high grade ores that is steadily growing in volume insure a finally satisfactory outcome. There is no camp in this country, if in the world, which has made or is making so large return for the money actually invested there as Cripple Creek.

AN INDIANA IRRIGATOR.

The original irrigator of Indiana is Captain Orville T. Chamberlain, of Elkhart, who has recently been presented by Congress with a gold medal for gallantry upon the battlefield of Chickamauga on September 20, 1863. Captain Chamberlain is a thorough believer in irrigation and has adopted it upon his large farm near Elkhart.

A BANNER COUNTY.

Scott's Bluff still continues to be the banner irrigation county of Nebraska. In a recent letter to the Omaha World-Herald, J. W. King states that he has farmed in Indiana and Iowa, but prefers Nebraska and irrigation to uncertain crops under rainfall. Charles H. Simmons is also one of the original irrigators of Scott's Bluff county, and he is enthusiastic on the subject. "Better crops, larger crops, and above all they are sure," is the way he puts it.

ARIZONA.

A hotel to cost \$150,000 is to be built in Phoenix by J. C. Adams, a Chicago man.

The Butte reservoir site has been withdrawn from public entry. It is in Pinal county and covers 1640 acres.

The property of the Agua Fria Construction Company was sold under attachment April 2. It is evidently a movement toward reorganization—a freeze-out of small share-holders, probably.

Governor Hughes was knocked down in the presence of at least three others. A newspaper man named Clark was the only one near enough to have done it, but nobody saw the blow, not even the governor, and Clark was declared "not guilty."

The Rio Verde canal company of Phoenix, Arizona, report that they have sold bonds to the amount of \$2,400,000, which will insure the completion of their irrigation system and is the most encouraging news that irrigation promotors have heard since the panic of '93.

The Phoenix Gazette summarizes the local conditions as follows: "Cattle men are happy, stock brings better prices than ever before, and the ranges have, in most localities, excellent pasturage. Every canal in the valley is full of water, and there is some to spare." With the expenditure of \$2,000,000 for the Rio Verde canal within the next fourteen months and the probable starting of other large works, there is reason for good times in Arizona.

The latest news regarding the status of the Gila Bend irrigation works is that all the interests, including the various construction companies and Governor Wolfley, have combined against the Peoria crowd. The litigation now goes to the U. S. Supreme Court, where a few years will be required before a decision is handed down. From what appears to be reliable authority, the Peorians tried to manipulate the irrigation enterprise à la whisky trust style, and are about to get the worst of it.

CALIFORNIA.

It has been a favorable winter for stock in most parts of the State.

The Producers Raisin Packing Co. of Fresno, is enlarging its plant.

A total of 488,710 tons of fruit were exported from the State last year.

Four hundred acres of olives are being planted at La Mirado near Fullerton.

The spraying of fruit trees is being done systematically at Fresno with excellent results.

There are ten Washington Navel trees being planted to one of any other variety of oranges in Southern California.

Moreno irrigators are being charged 35 cents an inch per day, the highest rate of any irrigation district in the State.

Redlands is prospering, having obtained fancy prices for its fine orange crop, which escaped the frost this year as it has heretofore.

The Sacramento Packing and Drying Company will pack the product from 230 acres of peas now growing in and around Acampo.

Japanese hemp is proving to be adapted for profitable cultivation. A fair yield is two tons per acre, and the market price 8 cents a pound. It is predicted that in two or three years California will have enough English walnuts, of superior quality, to supply the United States.

It is claimed that a million olive trees have been set within the last two years. California olives are steadily gaining favor in the markets.

The San Bernardino rock pile is short on labor. The industry is so little appreciated by tramps they are giving the country a wide berth.

It is stated that from forty to forty-five per cent. of the West-bound tourist travel this season have gone to make their homes in Southern California.

Higher prices for oranges at Redlands has created such a demand for trees as to exhaust the nursery stocks, and planting seed beds is again in vogue.

A poultry ranch with a capital of \$25,000, with capacity for an annual production of 90,000 broilers and 2,000,000 eggs, is being established near San Francisco.

The year's planting of orange trees has been unexpectedly large, and the demand for olive trees has been so enormous that the supply is practically exhausted.

Cahuenga vegetable growers have reaped a rich harvest this winter, shipping string beans, green peas and tomatoes to San Francisco. Tomatoes fruit there all winter.

The Redlands Citrograph says the "Damascus Town Site" is a "gigantic fraud, a tremendous fake, and a scorching swindle," being located out on the Salton desert.

The big storage reservoir of the Poso Irrigation District has been completed and the water turned in. It will take six weeks to fill it at the rate of 30,000,000 gallons daily.

The application of the Alta Irrigation District for the cancellation of its county assessments, on the ground that it is a municipal corporation, has been granted. It raises a point of wide-spread public interest.

Good orange lands are in active demand in Southern California at round prices, it being generally comprehended that the area of such lands, of good quality and safe from frosts, is comparatively very limited. A subscription of \$3,000 has been made to a cannery company at Redlands, conditional on a total local subscription of \$5,000 and payable when two acres of ground and a plant capable of packing 50,000 cans of fruit, and costing \$12,000, has been erected.

COLORADO.

Medford is sending 600 boxes of Newton pippin apples to the London market.

A large ice plant is being erected at Grand Junction, and is expected to be in full operation early in May.

Colonel R. J. Hinton, of New York, has been recently in Colorado examining a number of projects for Eastern capitalists.

The Greeley Tribune proves pretty conclusively it will not pay to feed lambs for market in that section on alfalfa hay at \$2 per ton.

The scarcity of snow in the mountains prompts the State engineer to caution water consumers to save and economize the probably limited supply.

Of the 250,000 acres of land that will be available for cultivation in the Grand valley when brought under irrigation only 75,000 acres are now under ditch.

It was estimated that in the Grand valley holes were dug for the planting of between 750,000 and 1,000,000 fruit trees when the water was turned into the irrigating ditches.

The Rio Grande Railway Company are arranging to erect a large fruit warehouse near the depot at Grand Junction to facilitate fruit shipments. The business has outgrown the usual methods of handling and present accommodations.

Professor Carpenter of the Agricultural Experiment Station is planning to make an irrigation survey of the San Luis valley during a portion of the summer, with the help of the water commissioners and ditch companies of that valley.

The Pawnee Pass Canal and Reservoir scheme, which will cover much excellent land on the north side of the South Platte river in Colorado, is expected to be built. There are now a number of corps of surveyors at work on the enterprise, among them being Messrs. Walters, Preston and Stimson, former students of the Agricultural College.

The supply of snow at present in the mountains of Colorado seems to be less than the usual amount. This does not necessarily mean that the streams will be low, but unless the rains of spring and of May and June are more abundant than usual, it will follow. With late snows the high waters are usually early, as the snow melts soon. The cutting off of the forests, and their destruction by fire, has caused the loss of the natural covering which formerly preserved the snow until much later in summer than it is now commonly found.

IDAHO.

Squirrel-shooting parties are necessarily popular in the Palouse country.

The construction of an irrigation plant is in progress for the Asotin flats in the Snake River valley, near Lewiston.

The Idaho Canal Company, under the presidency of Mr. Frank W. Smith, has commenced work, and 100 teams are now engaged in construction.

Two colonies of Iowa Dunkards, numbering about seventy in all, have recently located in Idaho. This is the beginning of a considerable movement.

The Electric Light Company of Boise has doubled the capacity of its plant. It now has 660-horse power, and will furnish power for manufacturing purposes.

A statement was recently made under oath in court by a well-known fruit grower of Lewiston that the average profit from his farm in a year was \$700 an acre.

An immigration congress has recently been held at Boise City, which resulted in a permanent organization to promote the general welfare of the State. An effort will be made to raise \$10,000 for that purpose.

KANSAS.

Arrangements have been made to extend the Amity irrigation canal twenty miles in the western part of the State. It is one of the best ditches in the West.

The State school fund has an accumulation of \$208,000. The officials are anxious to invest this in school bonds, but none are offered, and it will probably be invested in United States bonds.

NEBRASKA.

There will be a great many trials of windmill irrigation in the western part of the State this year.

A butter and egg station has been established at Niobrara, one of several along the Milwaukee line.

The Beerline and Smith irrigation ditch, near Hedberg, is completed, and they are counting on full crops this season.

The average yield from the sugar-beet industry in Nebraska is fifteen tons an acre. The producer is paid \$5 a ton. The tops, also, have a value.

NEW MEXICO.

A vigorous horticultural society is promoting fruit culture at Hagerman.

A beet-sugar factory is to be built at Eddy, \$185,000 having been raised for it, of which \$15,000 was a local subscription.

Efforts are again being made for the extension of the Pecos Valley railroad from Roswell to the Texas panhandle, to a connection with the Santa Fé.

The Taos valley, the garden spot of Northern New Mexico, is feeling the impetus from new capital introduced for both mining and ditch building.

The Maxwell Land Grant Company is doing a commendable work in getting out two carloads of cottonwood trees from the lower Rio Grande, to distribute among the settlers along the Vermejo canal.

Three extensive dams and irrigation systems are projected on the Rio Grande river. The International dam, just north of El Paso, Texas, which is to be built in order to insure water to the farmers in the Isleta valley, Texas, and to the Mexicans in Mexico on the other bank of the river, both of whom complain that they have a moral if not a legal claim against the United States for diverting the water higher up on the river, and so depriving the people around El Paso of their water rights. The Mexican government shows a disposition to provide half the necessary capital, and Congress will be asked to appropriate \$1,000,000 as the share of our government. A second dam is contemplated near Rincoe, the capital for which is being sought in London, but so far without success. A third dam is projected near Fort Seldon, and is in the hands of Chicago capitalists, who are making the necessary preparations to raise the

capital. The two latter dams will irrigate the Rio Grande valley north of El Paso, Texas, but as only one will be needed the first one to be built will make the other superfluous.

OREGON.

The K. S. D. Fruit Farm Company is pushing the work on its large farm at Ontario.

A dangerous skin disease has broken out among the Indian ponies near Pendleton, Oregon. It is in the nature of a mange.

Many hop yards are being plowed up in the Willamette valley. Low prices and vermin have made a discouraging combination.

Eastern Oregon stockmen are in rebellion against orders of removal from the forest reserves recently issued from the Interior Department. Immense herds have been feeding there.

UTAH.

The Mormon church property has been restored by act of Congress.

A large acreage of fruit trees is being planted in the Bear River valley.

A railway grade is being made through Provo canyon; nobody knows for whom.

The Bear River Irrigation Company are planning for a large movement of settlers to their lands this year.

Brigham gardeners and fruit growers report an absence of the usual worm pests, and anticipate a large and superior crop.

Sheep men are happy this spring. Their flocks have wintered well, there has been plenty of feed and the fleeces are large and of good quality.

Work has begun in earnest on the great power dam in the Ogden canyon, and the Union Pacific company has put in a branch track to facilitate the delivery of material.

The governor and legislature have memorialized Congress to set apart and donate a portion of the abandoned Fort Cameron reservation for the establishment therein of a State normal school.

Salt Lake City is gratified by a reorganization of the Oregon Short Line and Utah Northern railway, which makes it an independent line with headquarters there, and under the management of a Utah railway man.

Almost an entire section of land has been sold in five and ten acre orchards by the Bear River Valley Orchard Company under a system which insures the delivery of a well-grown bearing orchard at the end of six years. Payments are made in mouthly installments and the non-forfeiture plan, first adopted by this company, makes the investment a popular one.

WASHINGTON.

Spokane finds it necessary to curtail the use of city water.

The Spokane Poultry Show was a success financially and as an exhibition.

About seventy-five per cent. of the 50,000 trees that are to be set out in the vicinity of Ranier this season will be prunes.

Robert Scott has plowed up eight acres of hops on his ranch near North Yakima, and will plant 1,000 peach and apple trees, with which he has had great success in the past.

The Walla Walla Water Company has checkmated the city in its plans for obtaining its own water supply by buying the property and rights which it expected to utilize.

The corporation counsel of Spokane says he has 500 cases pending, and is about to commence no less than 2,000 new cases on behalf of the city. He asks allowance for a typewriter. It looks as though he might need more than one.

Professor Harry Landes has been appointed State geologist. The office was created many years ago, but was grossly misused and was abandoned as a dead letter. There is no State appropriation in its behalf, and the university assumes all the expense of an excellent equipment, and the official conduct of the office.

WYOMING.

The flock masters are preparing for the largest crop of wool on record.

Russian wolf hounds are being used successfully to run down coyotes.

A large immigration from Europe is expected in the Big Horn basin this year.

The Cody Canal Company has the first contract that has been signed by the President under the Carey act, for 70,000 acres to be irrigated.

TOPICS OF THE TIME

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Forest The theory upon which leg-Preserves. islation has been enacted for the preservation of forests in many portions of the West has been that by their destruction, either for commercial purposes or by fires, the absorption of the rainfall into the earth is retarded, and the snows melt more rapidly for lack of tree shelter. In a communication to the Fresno Republican, Mr. H. F. Dunnington cites the experience of mountaineers to controvert that theory, and asks attention to the following facts: That the snow lasts longer and is much heavier above the forest belts than under the shelter of the trees; that around and beneath the trees the snow melts and runs away sooner than where there is no shelter from the sun's warmth; that the glaciers and great deposits of snow and ice, which are the chief source of the river supply, are nowhere found within the wooded belts, and there is no eternal snow except where there are no trees. He instances that the valleys of Switzerland are neither burned up by droughts nor swept by floods, although surrounded by vast barren mountains. He maintains that the practice which prevailed during all the past among the Indians of an annual burning of the undergrowth and grass was not detrimental to the strong and healthy growing timber, and that the great injury has chiefly come since short-sighted enthusiasts have interfered to prevent the burning until the undergrowth has become so rank that an accidental fire causes the greater damage. He makes the sensible suggestion that legislation might better compel and direct the planting of new trees for each one utilized commercially. His article offers food for thought and suggests that there are two sides to this as to most questions.

An It is a matter of more than Unfair passing concern that the Advantage. beet sugar industry should be brought prominently to the public attention throughout the entire country. With Cuba's production reduced to almost nothing, and our legislation favoring the

German producers, we are sacrificing one of the greatest opportunities ever presented to our Western people. The irrigated sections are especially interested in this matter. Mr. T. R. Cutler, manager of the Lehi, Utah, sugar factory, was before the ways and means committee at Washington a few days ago representing the sugar beet producers. He made the point that the Germans were gaining an unfair advantage by reason of bounty. It was neither "free nor fair trade," and in his opinion the industry and capital of our country were entitled to protection against it as much as they were against the guns of a foreign nation. Germany was taking advantage of the Cuban war to crush our sugar industry, and he appealed to the committee to recommend an additional duty on German sugar.

Chances The Idaho Statesman would for not discourage the poor man Poor Men. from settling in that State. If he thinks he can see the opportunity to utilize his energy to good effect, he is welcome to come and try. It pertinently suggests that many of the leading men of the future will probably be from those who entered the State short of this world's goods, and who grasp the opportunities which are now presented, as they will not be when the development is further advanced. Look where you will, most of the wealthy men in all Western communities are those whose foresight led them to acquire property at its lowest value, and have seen it grow according to the wisdom of their selection.

Tired of the Cheyenne Sun-Leader, the commenting on Secretary Treatment. Hoke Smith's nullification of an act of Congress, which provides for opening of the Uintah and Uncompander reservations in Utah, says:

"The West is getting very tired of this kind of treatment, and unless it is changed there will come a time when the men of the West will not have it any longer. It has reached that point now when they are

asking themselves: 'How much do we owe these Eastern people anyway?' From their mines, the few people in the West have turned a stream of probably five thousand millions of dollars into the coffers of the East during the last forty-six years. When that big stream began to flow the East was so poor that it had no better credit than Egypt. Because of that stream it has become the foremost power in all the world, and in return these Eastern people treat the West as an encumbrance, inhabited by barbarians only fit to be governed by the strong hand of the federal power, and only fit for the work of the earnest missionary. In contemplating it, Western men reflect that when civilization goes to seed, and its utmost exertions are turned solely to making more money, it is worse in its effect upon the world than absolute barbarism."

It goes without saying that Fencing In or Out. if there had been a universal principle by which fencing could be regulated, and laws had been based on that principle, an immense expenditure, in the aggregate, would have been saved to the farmers of this country. The point has recently been raised and good argument presented why the fencing in of all stock kept by the farmer should be the rule. It does seem an injustice that a man should be permitted to let his stock run at large and trespass on his neighbors, perhaps unruly animals at that, and compel a dozen of them to build fences for their protection and his benefit, when there is no other necessity for such structures. If each farmer fenced such fields as he needed to pasture and that alone, and could be held legally responsible for damage caused by his stock he would certainly see that his fences were kept in order, and that the gates should be kept closed. He would have option as to how much land he would enclose, and would build only as necessary. involve no more care than is now necessary, and it would certainly require far less fence than is now in use, for which there is not only a large first cost, but a constant annual charge for repairs.

False
Economy. The secretary of agriculture is making a hobby of saving money out of the appropriations for his department. He even ventures to ignore the

specific acts of Congress, and, when compelled to execute the law as it stands, does it with the worst possible grace, and evidently with a view to making the seed department odious. Instead of seeking to carry out the law in its true spirit, which would be vastly beneficial to the farmers of the country, he is apparently willing to let his department become of actual disrepute among the people for whose especial benefit it was created, after a long and earnest struggle on the part of broad-minded and public-spirited men.

The There are no crops more worthy the attention of our Sugar people than are those adapted Industry. to the production of sugar, whether cane, sorghum, beets, corn or the maple tree. European countries have been forced to abandon wheat growing because of the low price, and they are finding it to their advantage to encourage, even by liberal export bounties the culture of the sugar Our market absorbs immense beet. quantities of their sugar and it is a pertinent question which hardly permits more than one answer, can they overcome the disadvantages of worn out land, long shipments, and pay the bounties and still derive a greater benefit from that crop than is possible to our own people with our fresh, strong soils, good transportation facilities and improved implements for the cultivation? The answer surely must be a negative.

No subject is worthier of sturdy Good Roads. thought and none of greater practical importance to the farmer than is the improvement of the roads over which he must transport his products. For this he must provide both the vehicle and the motive power. If it costs one dollar a ton to haul over the present soft and badly-kept roadway, there is a saving equivalent to that amount, if the road be put in condition to double the load upon each ton of traffic. A ton of corn to the acre is a fair yield and a saving of forty dollars on a forty-acre field is ten per cent upon four hundred dollars. A road tax for that amount would be startling, wouldn't it? And yet, measured on a business basis, as the banker, merchant, or railroad man would estimate, it would be a good investment. But that would be only a single item in the account to the owner of a 160-acre farm. If the reader will but compute in his own case the several items of saving in money, time and labor, to say nothing of the satisfaction of driving over good roads and the very considerable enhancement of value to the farm itself, he will find a complete justification for paying twice the amount that will be necessary to effect the percentage of saving suggested.

Gradually . Although the larger irriga-Improving. tion companies whose investments amount to hundreds of thousands or millions of dollars are not yet securing the full number of settlers which their original plans contemplated, and which are necessary to make their investments profitable, there is a steady onward movement which only needs two or three years of normal conditions to bring about a fairly satisfactory situation. science of practical irrigation is steadily advancing, and each year makes the proof yet more conclusive that it is the most perfect method of crop culture. To the individual farmer, it is almost universally profitable, and it is only necessary to make the company investments equally so that the lands shall be fully occupied. Several of the larger companies have been unable to pull through the long period of depression without such defaults as compelled re-organization, and in nearly every case there has had to be some indulgence exercised on the part of creditors. As a whole, however, the improvement of the situation is encouraging.

Changing It is an altogether erroneous Sentiment. idea that the necessity for irrigation is an objection to agricultural lands. No fruit grower having once experienced the positive advantages which the possibilities for irrigation afford would ever be willing to forego them, and the general farmer will find a positive saving in time, labor and money if he is in position to control the water supply and apply it at his own convenience. From all over the country we get reports of experiments being made within the rainfall area, the primary object being, of course,

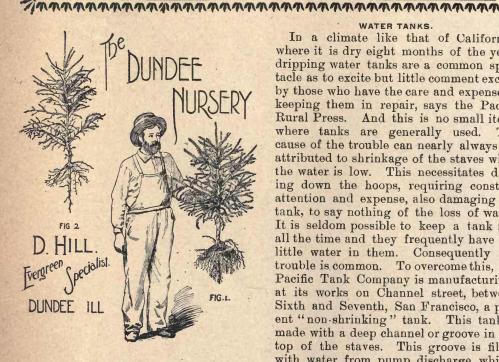
to insure against the effects of drought, which though of brief duration often occasions heavy loss. The results of such experiments are generally most encouraging, and those who make them ought to see that the experiment is properly recorded as to its cost and effects, with a view to publication for the benefit of the general public.

Farmers' There was never a time when farmers' institutes, clubs, societies and granges were so actively discussing practical topics of local interest and relating to their vocation. The papers, many of which are given a widespread utility by publication, are generally well expressed and indicate careful thought. The preparation of such papers cannot fail to be twice blessed in their influence—upon the writer and reader alike—and it is such study that adds efficiency and dignity to the farmer's calling.

"Irrigation's the thing," Chauncey says Chauncey M. Depew, Depew Converted. after a month's trip through the Western States. Like every one else who once enters the domain of King Water, Dr. Depew was converted quickly and easily, and he has now returned to the East to tell the farmers of that section a few of the "Blessings of Aridity." What matters it if the water does cost something, it's cheaper than fertilizers, and a crop is always assured. More power the silver tongue of the renowned doctor in teaching the Eastern public of the advantages and possibilities of the Great West instead of the Greater New York.

Garden The farmer who will give just Luxuries. a little thought and care to his garden may have almost every table luxury that is obtainable by the wealthiest. Instead of being the least important feature of the farm it may easily be made the means of the greatest possible satisfaction and comfort for the entire household. More than that there may be berries and fruits of the choicest varieties from earliest spring to the midwinter if the good housewife will pay a little attention to drying and preserving. Don't neglect the garden.

MACHINERY AND APPLIANCES



EVERGREENS.

The accompanying cut will give a very good idea of the advantage of growing evergreens by the method employed by the Dundee Nursery of which D. Hill, the evergreen specialist, is the proprietor and manager. Fig. 2 shows a Norway spruce as grown under ordinary conditions and without the proper transplanting and cultivation. Fig. 1 shows a tree of same variety and same age, but one which has had the advantage of the special knowledge and treatment of Mr. Hill. Every man who has had any experience knows that the prime essential in the selection of young plants or trees is a strong healthy root growth such as is shown in Fig. 1. good deep green and healthy color in evergreens, that which is so much prized by growers, can only be imported by an understanding and intelligent course of treatment. Those who wish to buy anything in this line can obtain a catalogue with full description free from the Dundee Nursery, Dundee, Ills.

WATER TANKS.

In a climate like that of California, where it is dry eight months of the year, dripping water tanks are a common spectacle as to excite but little comment except by those who have the care and expense of keeping them in repair, says the Pacific Rural Press. And this is no small item, where tanks are generally used. The cause of the trouble can nearly always be attributed to shrinkage of the staves when the water is low. This necessitates driving down the hoops, requiring constant attention and expense, also damaging the tank, to say nothing of the loss of water. It is seldom possible to keep a tank full all the time and they frequently have but little water in them. Consequently the trouble is common. To overcome this, the Pacific Tank Company is manufacturing, at its works on Channel street, between Sixth and Seventh, San Francisco, a patent "non-shrinking" tank. This tank is made with a deep channel or groove in the top of the staves. This groove is filled with water from pump discharge, which, by absorption, passes into the pores of the wood, keeping the entire tank moist at all times and preventing shrinkage. A catalogue will be mailed on application if you mention THE IRRIGATION AGE.

CARRIAGE CATALOGUE.

A very handsome and elaborate illustrated catalogue of Buggies, Surreys, Phaetons, Farm Wagons, Road Carts, Harness, Saddles, and Horse goods, showing a great variety of styles and shapes, has just been issued for 1896 by the well-known Alliance Carriage Co., of Cincinnati, O. This enterprising company prints the prices in plain figures (factory prices) in their catalogue and send goods anywhere subject to examination. Any horse owner can have a catalogue free if he mentions The Irri-GATION AGE.

A SATISFACTORY FILLING.

Tramp (at dentist's door)—"Please, sir, could yer fill me teeth this morning?" Dentist-"With silver or gold?"

Tramp—"Cold roast turkey would do." -To Date.

THE IRRIGATION AGE.

VOL. IX.

CHICAGO, JUNE, 1896.

No. 6.

IRRIGATION IN VICTORIA, AUSTRALIA.*

CHAPTER I. GOVERNMENT AID. FORMATION OF DISTRICTS.

BY OUR SPECIAL CORRESPONDENT.

SOIL eminently suited to the growth of cereals and fruit trees is found over a large area in Victoria where the climatic conditions are unfavorable. The average annual rainfall varies from seventy inches on the coast ranges to nine inches over the northern and western plains. sunshine and dry air of these interior plains are well adapted to mature fruit to perfection, but the deficient rainfall makes fruit production uncertain. To render producers independent of rainfall and to enable them to make the most of the soil at their disposal, irrigation trusts have been formed, a brief description of which, with a more detailed account of one or two as types of the east, may be of interest to your readers in America. Victoria is divided into two portions by a high range running generally east and west. The humid air currents from the south deposit their moisture on this range, thus forming a large gathering ground, from which are fed numerous streams which run north to the Murray River, the northern boundary of the colony. The plains to the north of the divide are thus deprived of much of the rainfall, which under other physical conditions would have been deposited on them, but in compensation have ample supplies of water running through them in the form of streams sufficient, if properly conserved and directed, to furnish all the moisture necessary for the production of cereals and fruits. To this conformation of the country is attributable the fact that the majority of the trusts are situated near the northern center of Victoria.

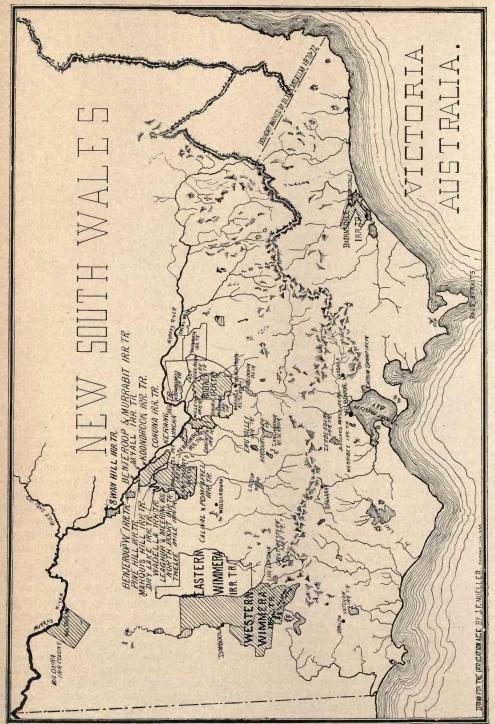
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Prior to the formation of the trusts private owners of property had erected windmills or provided small steam plants, for raising water for stock, and incidentally for irrigating gardens and small areas of crop, etc., but it was not until 1881 that the Victorian legislature passed an act authorizing the constitution of water supply trusts. This provided that nine councils, into which the colony is divided for the purpose of local government, could form themselves into such trusts, subject to the approval of the government from whom they could borrow money necessary for the works, repaying principal and interest by the revenue received from rates levied within the area under their control.

The trusts formed under this act were not only for agricultural and horticultural purposes but also for providing water for stock, for which purpose existing water-courses and depressions were made use of, to fill which, water was conserved at convenient places and permitted to run into them at stated times during the dry season.

VISITED AMERICA.

The bill was found to be only partially successful and was amended in succeeding years, until at the close of 1884 a royal commission was appointed "to inquire into the question of water supply and into other matters relating thereto." The chairman, Mr. Alfred Deakin, member of the legislative assembly, visited America for the purpose of studying irrigation in its latest application, and information was also obtained on the subject from various countries of the old and new world.



IRRIGATION TRUSTS IN VICTORIA, AUSTRALIA. Shaded portions show completed trusts. Black lines indicate proposed trusts.

The result was a valuable report upon which was based a comprehensive measure, called the irrigation act, 1886. provides that any district, upon application to the executive government, giving plans and full particulars of the proposed scheme of irrigation and water supply, including cost, maintenance, probable revenue and necessary rating power, may be constituted an irrigation trust, provided that the opposition to the scheme in the proposed district is not greater than a specified minority, and provided that the minister and chief engineer of water supply report favorably on it. government having approved of the application the scheme has then to be laid before parliament with all documents, etc., relating thereto, for its sanction. A specially authorized loan is then granted to the trust from a fund specially set apart for the purpose to enable the necessary works to be carried out. A small rate of interest is charged and a sinking fund provided to extinguish the loan. It is also enacted that certain portions of a scheme may be denominated "national" works and paid for solely by the state; or "joint" works, payment being made by both state and trust; or "trust" works. for which the trust alone is responsible.

The trusts are managed by commissioners elected by ballot of the ratepayers in each district, who have full financial control and responsibility in connection with the undertaking, and who appoint the necessary officers for carrying out the works and controlling the supply of water.

Great facilities were thus afforded to districts in which the rainfall was deficient of obtaining an adequate supply of water. The value of this boon was soon recognized, no less than thirty trust districts having been formed since the passing of the act, comprising a ratable area of 2,700,000 acres, to which advances have been made by the state to the extent of £974,000 or about \$4,870,000. The total sum authorized by parliament to be lent to the trusts is £1,364,000 (\$6,820,000). In addition the State has expended the sum £799,000 (\$3,995,000) on national works, thus the total amount advanced to and spent on the behalf of irrigation trusts is £2,163,000 (\$10,815,000).

AREA IRRIGATED.

All the acreage mentioned as conferred

in the first district is not irrigated although ratable. Some of the schemes have been allowed to lapse and several are merely commenced. There remains, however, fully 1,300,000 acres which may be brought under irrigated culture when all the schemes are in full working order. The annual returns to end of 1895 given by the department of water supply show that 76,600 acres have been watered during the past year. Of this total, 30,000 acres consisted merely of grass, 20,000 acres of cereals, and not more than 2,900 acres of vines and fruit trees; the balance being made up of lucern, vegetables, flax, maize, tobacco, etc. This leads to the conclusion that the expenditure has been much in advance of present require-That this is so is also shown by the fact that the returns to the state in the shape of interest for money lent is greatly in arrears, the sum outstanding exceeding £160,000 (\$800,000).

In many cases the trusts saw no more than the advantages likely to accrue to their districts through possessing a sufficient water supply, and did not consider seriously enough the large liability they assumed for the repayment of principal and interest of the loans they had received from the government, or if they did understand the position they probably relied upon the leniency of their creditors to postpone the day of reckoning until it was quite convenient for them to pay up. Further, at the outset few knew anything of irrigation in a practical way, and especially were they ignorant of the large expenditure necessary to bring land into a fit state to be irrigated. When it is considered that most of the land included in the trust districts is held in blocks of at least 320 acres, it will be seen how large an amount would be received before any considerable area could be utilized for "intensive irrigated culture." The result has been that the available water has not been made use of to anything like the extent contemplated when the schemes were first proposed. The situation, indeed, had become so serious in 1894 that a royal commission was appointed to investigate the affairs of the various trusts. and make recommendations for this amelioration. This body has not yet completed its report.

The methods of rating are not yet uniform; in some trusts each acre is rated

the same, in others there is differential rating according to distance from the channels. According to the water act, 1890, which consolidated previous statutes, and therefore superseded the Irrigation act, 1886, all water used for irrigation purposes must be paid for by measure, but for watering stock and domestic supply, payment may be made as the commissioners of the trust direct. For irrigation therefore a rate of either 6d per inch, 6d per inch per acre or 1d to 2d per 1,000 gallons is charged in addition to the general rate which varies from 1 to 3 shillings in the pound of actual value.

Looking at the present position of the irrigation scheme in this colony, although the expenditure was at the outset on a scale far too lavish for the limited population likely to avail themselves of its ad-

vantages, still there is no doubt but that the value of the land within reach of the water channels has been largely increased, and it has been made evident that by means of an artificial water supply the arid plains of the interior are capable of supporting a very large population. With an arrangement to relieve to some extent the heavy liabilities lying upon the trusts, and an increased settlement of people on the land, which such an arrangement would facilitate, the future of irrigation in this part of the world is by no means gloomy. We are a young colony, both enterprising and sanguine and not to be dashed by the clouds of temporary depression, as the returns of our exports clearly prove.

In future papers, some of the more important trusts and their works will be

dealt with in detail.

IRRIGATION BY PUMPING.

THE RECLAMATION OF THE GREAT PLAINS. "A WAY OUT."

BY H. V. HINCKLEY, C. E.

FIFTEEN to twenty years ago, when Providence smiled upon the Great Plains to the extent of thirty inches, or even more, of rainfall, immense crops grown wherever anything was planted, for the richness of the virgin unwashed soils needs only water and labor to speak miracles to the New England agriculturist. But the newcomers who depended upon such annual rainfall being furnished by Uncle Sam along with the land titles were disappointed and a million homesteads have been abandoned which with water would produce bountifully. Many cities (real cities which had hotels, banks, etc., ten years ago) are now marked only by cellar holes and corner stones. These are blue statements, but they are facts. As in all arid or semi-arid countries since the beginning of history so in Western Kansas and Nebraska, for example, a lack of appreciation of the need and advantages of an artificial water supply has resulted primarily in destitution and depopulation.

The densest populations of the world

have been founded upon irrigation agriculture, but they irrigated only when they had to irrigate to live, and only then have they been aroused to a realization of the immense benefits, the profits accruing Under the new order of therefrom. things some of these abandoned homesteads are already becoming valuable. will not be possible to irrigate all the plains country. Probably between fifteen and thirty per cent. of the area can be finally brought into successful agriculture. The irrigable per cent. varies from none on some divides to one hundred in some valleys.

Land values in the Arkansas and similar valleys having an abundant and reliable underflow are bound to advance, while the high lands without water must be devoted to alfalfa and cattle.

Alfalfa is a very deep rooting clover that responds handsomely to irrigation, and yet lives and produces fair crops where all other grasses fail—where water is at a premium. It is already being extensively and successfully grown even without irri-

gation on quite high lands. It frequently nets \$15 to \$40 an acre above all expenses, and needs but little attention except at harvest—three to six times a year; the average net income officially reported by Finney county, irrigated and unirrigated, being \$21.45 per acre per annum. The plains need pumps and people in the valleys and cattle on the high lands.

The plan of the Alfalfa Irrigation and Land Company of Topeka may be cited as presenting the writer's ideal of the correct "Way Out" for the Great Plains.

comers (each tract to have its own pumping plant) and into sugar beets and alfalfa for hogs and cattle. Thus will the present unfortunate land owners realize upon the productive value of their investments instead of paying taxes and getting no returns.

Capital will do the developing, but each

irrigator will be independent.

The handsome profits on alfalfa have brought forth from the conservatives the cry that the supply must soon be greater than the demand, and prices and profits must go down.



L. L. DOTY'S CABBAGE PATCH, IRRIGATED.

WHAT IS BEING DONE.

Lands are being secured from non-residents, to whom they are without value, in exchange for capital stock, the higher lands at nominal figures, for their pasturage value can not exceed \$1 or \$2 per acre, and the valley lands at figures depending upon local demand. The high lands are to be consolidated and fenced as large pastures with an occasional quarter of alfalfa. The valley lands are to be pump irrigated and put into small orchards and vegetable gardens for new-

A company that feeds its own alfalfa to its own cattle and hogs and gets a hundred pounds of best beef for the Lords of London from each ton of alfalfa, can regulate its own demand and supply and obtain spring instead of fall prices. In the corn belts of Eastern Kansas the cattle are "finished" for the Kansas City and Chicago markets, which handle five million cattle and ten million hogs annually.

The era of the dry farming lottery is passing. Crops are no longer scratched



ALFALFA STACKS.

in upon unbroken lands by the square mile, but are being planted, subsoiled and watered, and are yielding surely and abundantly. A maximum crop beats a stinted crop. A maximum crop every year beats a fair crop occasionally, when the rain happens to fall just right.

Irrigation is the only insurance that provides against droughts, hot winds and frosts and that pays to the policy holder annually the full face of the policy and pump irrigation is the most reliable of all.

COST OF IRRIGATING VALLEY LANDS.

Millions of acres of valley lands now held at \$5 to \$12 an acre, having under them the most reliable of all inland water supplies, can be supplied with pumping plants at \$5 to \$10 an acre, and can be irrigated with an annual expense of \$1 to \$5 an acre (power, repairs and interest), and be made to pay ten per cent. net on \$100 to \$200 per acre, and often several times these figures. The pump irrigator is free from monopoly control of water, from canal and reservoir management and from the vexatious and costly delays resulting from water supply uncertainties and canal failures. He erects his own pump on his own premises, pumps his own water into his own reservoir. irrigates at his own pleasure, and does his own superintending and adjudicating.

While the millions of acres of high lands must be devoted mainly to alfalfa and cattle, the man who is fastened there by other business than farming can, by pumping water, grow at least the garden produce necessary for family consumption and perhaps sell some to his neighbors.

For each locality and for each size of farm in each locality there is but one style of plant, one kind of pump and power and one size of reservoir that results in the best capitalized pumping investment and, while the writer has been collecting and tabulating data on this subject from experiments and actual results on high and low lands for two and a half years, the relative merits of the various pumping plants is intentionally omitted from this article.

While the purchasers of high lands on the plains, "unsight and unseen," are losers, I am convinced beyond question that lands in the Arkansas valley or any other valley having as reliable an underflow, are among the best investments in the country at present prices. They must be worth \$50 to \$100 an acre when supplied with pumps and people; and when the water supply and the cost and advantages of pump irrigation become better understood, the valleys will be continuous gardens, vineyards and orchards; the high lands will be pastures of native grass and alfalfa. In British India three million acres are irrigated with water pumped from wells. In the United States of America, and not alone upon the plains, pump irrigation is in its infancy.

[Note.—The author requests us to state that the photo of the Waymire reservoir on page 190 and the reference thereto on page 186 were inserted by us without referring the matter to him.—Ed.]



DITCH FROM FRIZELL'S RESERVOIR.



IRRIGATED APPLE ORCHARD IN KANSAS.

THE ART OF IRRIGATION.

CHAPTER XIII. THE GREAT FLOODING SYSTEM OF THE SAN JOAQUIN VALLEY.

BY T. S. VAN DYKE.

THE immense scale on which water is handled in the great central valley of California is worthy of a special study because there is no other place in the United States, and probably not in the world, where water is so intelligently used in such vast quantities on so large an area. At the same time the methods cannot be recommended in all respects for the small farmer, though for extensive work with plenty of water at command they are hard to improve upon.

Kern River, draining the lofty country south of Mount Whitney, rolls out upon the great plains of Kern County over two thousand cubic feet average flow for the dry season, or over one hundred thousand miner's inches. This is generally much increased when the snow is melting, making the summer supply very large and reliable. This with the winter flood-water once made about a quarter of a million acres of shallow lake and swamp covered with reeds and tule and willow bordered sloughs, exhaling all summer long a malaria almost as deadly as that of Panama. Bordering this on the east side of the valley were half a million acres of fine granite soil drifted in the course of ages from the hills and lying on a slope

of about fifteen feet to the mile though looking level as a floor. No finer soil for all around purposes is to be found in America; but twenty years ago it was the most hopeless of all deserts, for the average rainfall was a trifle over four inches, the Coast range on the west and the continuation of the lofty Sierra Nevada to a junction with the Coast range on the south, cutting off most of the winter rains.

The same stroke that would turn the waters of the river upon this arid land would reclaim all the swamp which was the richest soil imaginable. But it was a job no state would undertake, and it was absurd to expect private capital to build canals in such a country and wait for settlers. The few jaundiced hog-and-hominy settlers that lived by fiddling and fighting along the river and claimed all its waters could not even handle the river so as to take out enough for themselves.

Messrs. Haggin, Carr and Tevis had the desert land act passed, it is said, so that that they could grab this land. If so they deserve the thanks of California, for it has added a rich county that would otherwise have raised little but scenery, dust and malaria. They spent some twelve millions of dollars in building canals of which there are now twenty-seven. The diversion of the water brought on the great riparian suit with Miller & Lux, who were very wealthy and were attempting to drain out the swamp below so as to take that under the swamp and overflowed land reclamation act. It is said that litigation cost each party nearly a million of dollars. The total cost to both parties could not have been far short of that. The outcome was a compromise by which Buena Vista Lake, a shallow lake covering over a township, was turned into a reservoir. By this the entire flood flow of the river is stopped, the canals taking all the ordinary flow. It now covers twentyseven square miles to an average depth of ten feet, making a store of water which hardly shows the great draught for Miller & Lux's immense farms below. Thus was added to the state more water than was then held by all its other reservoirs combined. As I hunted ducks over these immense properties last winter I remarked to a friend that there were two sides to the monopoly question.

Miller & Lux have under this water

over one hundred thousand acres mostly reclaimed swamp of which over twenty thousand are now in a solid block of alfalfa. The Kern County Land Company, composed of Tevis, Haggin and Co., have under the ditches on the dry side some four hundred thousand acres with one patch of about thirty-five thousand acres of alfalfa.

The difference between this reclaimed swamp and the land that was once desert must be kept in mind on account of the different ways of irrigating hereafter mentioned. On the reclaimed swamp, which is a black muck of tule roots running into peat in many places, the level of the water below is from eight to ten feet. On most of the upland reclaimed by the ditches it is from sixty to almost as much more as you wish.

The method of preparing the land is the same in both cases. The slope is so nearly uniform that on the greater part there is no leveling. Where it dips into swales or old dry slough beds it is terraced roughly with scrapers to very nearly a level, the shape and size of the terraces varying continually with the contour and dip of the land. No rule is followed except the uniform method of having one check enough below another to permit the rapid emptying of the upper one into the lower one if the water is to go there at all. They vary from half or quarter of an acre up to five acres or even more, and though they look like a set of plats running through all shapes from the crescent to a square they are really terraces.

LAYING OUT THE CHECKS.

On the land having a very even slope the checks are almost invariably made on contour lines laid out with an engineer's level. Starting at the upper side of the field the level is swept around and stakes set every few yards on a line about a foot below the instrument. If the slope is uniform the line of stakes will be a crescent and will vary from this in all manner of wavy curves according to the change from a regular slope. The level is then moved down to the line of stakes and another line of stakes set below that, care being taken not to leave ends or horns on the crescents in which the depth of water could be too slight. Rather than do this the shape is changed and a square or

other figure thrown in between true contour lines.

As thus run, some of these check lines are nearly a mile long. The checks thus formed run from about twenty acres up to two hundred with an average as near as I could judge of about forty acres. Near Pozo, in Kern County, are several thousand acres laid out by the eye by a Chinaman who was an experienced irrigator. I saw it under water and it was well enough done, so well done that I am certain that with a carpenter's level fitted with rifle sights and a common tripod any one with sense enough to take the height of the instrument on a rod marked plainly into feet and tenths of a foot, and with enough arithmetic in his head to add or subtract the readings from the height of the instrument, could lay out any ground well enough for good flooding.

The embankments made on these lines vary in height from fifteen inches to twenty or even twenty-four inches, the average being nearly eighteen for the central part of a whole line so as to allow a foot of water behind it with no danger of its being breached by wind or defects. At the lowest point the water is often deeper than a foot and at the shallowest points much less, but the general aim is to have it everywhere as near a foot in depth as possible though it by no means follows that that amount of water will be

run into it at every irrigation.

At the bottom these check lines are often as much as eighteen feet in width though twelve to fifteen feet are more common widths for the high parts. They are round upon the top with both sides on such a slope that any kind of machinery can be run over them and cut anything that grows upon them as well as if it were on the level. The alfalfa, grain, or whatever is in the field is planted upon them the same as in the bottom of the check and, as far as can be seen, grows as well.

At the lower part of some of the checks is a large gate in the embankment large enough to discharge the water quickly into the next check below. But in most cases the reliance is on cutting with a hoe. It is conceded by the superintendents that the gate is much the better and in the long run probably more economical, though more expensive at first.

These embankments are made with a

buck scraper or a Fresno scraper and are too large to make with a common plow in any case. With a movable moldboard about ten feet long a common plow may be used to make them if they are not too But this makes a heavy drag and for some of the largest checks takes ten horses in heavy soil. In place of the moldboard five or six revolving disks like those on the disk cultivator are set on an axle eight or ten feet long inclined according to the slope and the whole fitted to a well braced frame of a Stockton Gang Plow. One of these was being tested the day I was there and I saw four horses do the work of eight with it in throwing up a ridge, the whole difference being in the friction of the solid moldboard, the disks turning over instead of resisting. A slip scraper or any kind that bounces will be too slow to do such large work economically. Even the machine above described must have broad wheelbraces rolling against the face and bottom of the cut to relieve the extra friction, or more horse flesh will be needed at once. All this would be too expensive for a small farmer, but for flooding on a large scale it would pay any one to begin checking in that way.

It must be remembered that there is plenty of water here and some things are done that might be inexpedient elsewhere. If you are sure to have water to fill them it is best to have the checks high enough, provided your soil or crops will stand a considerable depth of water. But if you have not the water or have it in heads too small then your high checking is useless ex-The depth of water you may put in a check will depend not only on the soil and the crop, but greatly on the length of time you hold the water in the This you should determine in advance by experiments on a small scale if your neighbors' places will not show what it will do. Under the hot sun of the San Joaquin summer, alfalfa will often scald in less than three hours, and if the irrigating water is very warm two hours are none too safe on some spots. Hence the water must be put in and let off quickly. But unless the soil is porous enough, too great a depth of water will puddle it and retard the soaking instead of hastening it, and if porous enough to be wet more quickly by greater depth of water then you must have a considerable

depth so as to leave water to run into the next check. For on this big scale laterals cost money and it is strict economy to make one check feed the next one for a

pretty long series.

Checks thus made will last practically forever, the alfalfa or grain preventing their washing. They become in time as hard as any canal bank, and the only weak spot is the place where they are cut. This is purposely left weak to avoid the labor of cutting every time which is considerable where they are of full strength.

TURNING IN THE WATER.

When all is ready to turn in the water, eight or ten men, armed with hoes, take a line of checks, and a head of about thirty cubic feet a second or 1,500 miner's inches is turned into the upper one. If a large one, there is considerable waiting to do, but if a small one it is not long before it is time to cut the lower bank to let the water into the next one. In a small check one cut is generally enough, but in a long one, two or three, and even four cuts, may be necessary to empty it fast enough. These cuts are quite large and let a great volume of water through. Ten men can handle this head of water and irrigate 200 acres a day with it on an average. erally seven can do it, unless there are a great many small checks to fill and empty. Where they are very large two or three men can do it, and there are places where one can do it. There a single man on the line of bank between two checks of 200 acres each reminds one of the old hymn-

"Lo, on a narrow neck of land,
"Twixt two unbounded seas I stand."

I tried to get a picture of one of these, but it is too large for a common camera to

bring out well.

At the rate of one man a day to twenty acres this is very cheap flooding, and it can hardly be done on the scale requisite for good orchard work, to be followed by cultivation. For the only safe way to do that well is to make the checks small and have the water shallow in them. For handling these with a head of two cubic feet to ten acres, two and generally three men are necessary for very good work. A piece of land so flat that ten acres can be managed by one man on a small scale is not likely to be well enough drained to be good orchard land.

Sometimes enough water is at once let

into the upper check to feed the whole line of which that is the first, and sometimes more water is allowed to run through it to add to the first instalment. This depends on what is in it and how it will stand the run of water; old alfalfa standing a good deal if there is no danger of scalding. The whole is so arranged that any surplus at the lower end has a waste ditch to receive it.

When these checks are emptied plenty of wet spots remain, with water an inch or two and often three or four inches deep. These are depressions which it was not thought worth while to fill by leveling off the tract. Probably the results would not, for low-grade crops, justify the expense where land is so plenty and water so cheap. But this will not do for the small farmer to imitate, and the effects of it can be quickly seen even in winter, when the sun is not hot enough to scald the plants or to bake the ground much. Of barley, wheat and young alfalfa about one-third of the stand is destroyed by a depression of about two inches, and about two-thirds by three or four inches. In some places where the water had been so deep that it was impossible to make an estimate, it was practically all destroyed. That is, if the whole field were in that shape it would be too thin to be worth cutting. Old alfalfa seemed uninjured. There was no grain old enough to show the effect on old grain, but it would not have been as bad as with the young grain, though anything but good. In hot weather the effect would have been much worse. It is due principally to the water standing too long and deep. On account of the pressure it would take the water that remained in the depression much longer to soak away than if that were all that had been put in there in the first place.

Smaller checks, and especially square or rectangular ones, for lands lying like these and bearing such crops, on so large a scale, would merely increase the cost without any corresponding advantage. The larger they can be made the greater area a given number of men can handle, and the only limitation on the size is the depth of water in them and the facilities for getting it quickly in and out again when it has done its work.

There seems no doubt that all this work is profitable. Miller and Lux are not offering any land for sale, yet they are

constantly increasing the area in crops and making new canals, and laterals by the league, that in most countries would be respectable canals. They have 200 men in constant employ, and have a thousand or more during most of the summer, with many more in harvest. The whole is in charge of Mr. Miller, who is one of the best business men of America. In forty years the firm has risen from poverty to the largest land owners and cattle owners on the coast, if not in the world, their present holdings being estimated at 200,-000 head of cattle, with sheep beyond the knowledge of even themselves, and 2,000,000 acres of land. The business has all been built up by Mr. Miller, whose principle has always been to make everything pay. It is therefore safe to assume that this handling of the water and land is profitable on a large scale, though it might ruin a small farmer. Even at the present low price of wheat, the superintendents say there is still a profit in it on this land, and there were some 8,000 acres already seeded when I was there, with more going in.

On the lands of the Kern County Land

Company 800 men are employed the year round, with an increase of thousands during haying and harvest. Though their land is for sale in small tracts, the gigantic scale on which they are farming the rest shows that the owners, who are also shrewd business men, know what they are about. They have also been at it long enough to find out, and are certainly not working eight or ten townships to make a show to sell out on. And the fact that thousands of acres of their lands are rented out to grain farmers whose long strings of teams and plows dotted the great plain for leagues, renters who are no tenderfeet at the business, makes it pretty safe to say that there is here a fair profit in raising wheat by irrigation, even at the present About the profits of the alfalfa, even at the low price of beef, there is no possible question, one acre carrying an animal the year round and in summer fattening five, while the constant trampling of the herds seems to have no effect upon the stand of alfalfa, which would be quickly injured if water were scarce or stingily

IRRIGATION IN NORTH DAKOTA.

BY W. W. BARRETT, STATE SUPT. OF IRRIGATION AND FORESTRY.

A S The Irrigation Age is the representative journal of the Union, especially of the West in the matter of Irrigation and Forestry and kindred subjects, I feel at liberty to speak through its columns of these things as they pertain to the commonwealth of North Dakota.

Water is of paramount importance in the economy of nature, especially in its operations in the production of grain, grasses, fruit and vegetables, and during the last few years this subject has received much attention throughout the world. This applies in a specific sense to the western portion of the Union and North Dakota has kept pace with the great advancement. Having been a resident of the State when a territory, until the present time, and having taken an active interest in its development, I can speak understandingly upon this point. The first public movement was made November 2, 1889, at the Irrigation and Forestry Convention at Devil's Lake, Ramsey Co. From that day to this these two subjects have been constantly before the public. The agitation has been carried on through mass meetings, proper handling by the press, legislative discussions, and reports from this department. Thus a marked and healthy public sentiment has been developed favorable to these two great and most important factors. And the results, though not what the most sanguine might desire, are of a practical and beneficial nature.

The progress made is indicated by the encouragement given by the press in the discussion of the subjects, the favorable laws passed by our Legislative Assembly, and the approved work of this branch of the state service, and also in putting the theory into actual operation in the sinking of artesian wells for various purposes. Besides establishing and maintaining the office of state superintendent of Irrigation and Forestry, our code contains some of the best laws in relation to irrigation which can be found in the west; all clear, concise and fitted to the water and irrigation conditions of our state. Proper provisions

are made for the bonding of townships for the sinking and maintenance of artesian wells. New artesian wells are being put down from season to season and the operations of the wells are satisfactory.

In all the Western States some persons are found who contend irrigation should make greater strides; the same is true of our state, but there is a constant steady gain, as a rule, throughout the different states which is a sure evidence of future practical advancement and the fullest material benefit. The proper use of water for producing the largest crop and the greatest profits in the cultivation of the soil is destined to constitute, as is now the case in some localities, one of the chief elements of our western civilization, and the trend of events point unerringly to this most desirable end.

We have in North Dakota 673 flowing artesian wells, twenty of which are deep-seated and the balance shallow wells. The shallow wells are from 100 to 200 feet deep, and the cost of construction is small. The deep-seated wells are from 800 to 1,500 feet deep, and the cost is governed much by the nature of the various strata, size of pipe, etc.—about \$3 to \$4 per foot. The flowage varies. I name a few sample wells:

wells:	Gals. per	Lbs. per Sq. inch
Jamestown (City)	minute . 460	Sq. inch 97
Oaks	. 817	125
Ellendale	. 700	115
Grafton	. 600	12

All water healthful and some of it soft. Artesian wells are located from the extreme eastern to the extreme western line, and from the southern to the northern border. and in the eastern central part of the state. The one on the extreme western line is located at Madora on the little Missouri It is a characteristic well, 800 feet deep with a good flowage of soft water. The one at the northern line is situated at Delorane, Manitoba, close to the northern border of the Turtle Mountains, nearly twenty miles from the international boundary line that runs through the wooded mountains. This fine, heavy flowing well gives evidence that the artesian deposit underlies the Turtle Mountain district. We have numerous artesian springs in North Dakota. One at the southern edge of the Turtle Mountains give a flow of 283 gallons per minute. There are others having as large a flowage.

The Dakota Artesian Basin is the largest in the world, and it is located in North and South Dakota, in both of which states its waters are developed. Much interest is taken in South Dakota in artesian irrigation, and its application there has proved to be most successful and remunerative to the irrigators in the raising of agricultural

productions.

During the last year a strong sentiment has been manifested in our state to make an extended application of the waters of our great artesian basin for agricultural purposes. The State Immigration Convention, held at Fargo, North Dakota this season, pronounced in favor of a governmental survey of our artesian deposits, and urged their development and use by the people in their agricultural pursuits.

IRRIGATION PROGRESS IN NEBRASKA.

By I. A. FORT.

IRRIGATION is applicable to all sections of the United States. There are times, even in those sections where the rainfall annually exceeds fifty inches, that if the plants of the farmer could only obtain a few refreshing drinks, the yield would be doubled. The plant is like a strong team that has been checked in its progress; that cannot reach the point that would be attained because water is not at hand at the proper time to supply the animals in order that they might go on. The plant has, like the average of the horses,

cattle and other animals of the farmers, a period of growth, and when that period is reached the growth stops. Irrigation enables the plant to travel steadily onward. The coming farmer in America will in a majority of cases irrigate or feed his crops; they will be fed with the same care as the successful cattle or hog raiser feeds his stock. Irrigation will restore the worn out fields of New England and the South, and it will reclaim the lands now abandoned in many portions of America.

Water is not only a powerful fertilizer, but it also promotes the disintegration of soils, thereby liberating the elements necessary to the growth of plants. Place upon certain soils fertilizers of certain kinds, and leave them to be acted upon by the chance rainfalls that may occur, and frequently three-fourths of the best elements in these fertilizers are lost through evaporation or seepage. Irrigation can prevent this, and the gain that will accrue through the additional effect of the disintegrating power of the water will be very great.

They have been irrigating in Spain and Italy for centuries. Biblical lands, once under the dominion of the Roman Empire, held and maintained a vast population through their systems of irrigation. Their magnificent works were allowed to decay and the country became depopulated. The Americans now in Arizona are restoring and have now restored irrigating canals that once fed and maintained a

heavy population.

Through a system of irrigation lately adopted in Louisiana, rice crops are successfully grown on elevated bench lands that lay above the stream and river. was formerly necessary to grow this crop in swampy land that could be easily flooded. Now the water is lifted by centrifugal or other kinds of pumps, the land flooded and the crop grown. The land is drained and the rice cut with a harvester, the same that is used to harvest wheat in Dakota. With their sixty-four inches of rainfall annually the Louisiana farmer finds it advantageous to irrigate his oat and corn crop.

Of the States that have actively taken up this question in the last three years, we find Nebraska leading. Canals have been constructed, or are now under construction, that will irrigate over a million acres of her surface. The cost of these canals for their irrigating capacity does not exceed in the great majority of cases

over \$2 per acre.

Nebraska is now rapidly following her sister State of Kansas in the erection of thousands of the new irrigation windmills. These mills have from four to five times the power of the old farm pumping mills of the same size. The best practical illustration of the difference in these mills is seen upon the farm of Wm. Stafford, of Big Springs, who had at work in 1894 three 12-foot and one 14-foot farm mills.

In the spring of 1895 he placed in position a 12-foot irrigation windmill attached to a 12-inch direct-acting irrigation pump. All the mills pumped the water into the same reservoir, and from the same depth. The 12-foot irrigator, so Mr. Stafford says, pumped more water than the other four. Where windmills are used, reservoirs are always constructed so that a good supply of water may be obtained, in order that when applied it may be conducted rapidly over the fields. So important is this attachment that a mill that will only lift water sufficient to irrigate one or two acres, will with the reservoir irrigate ten or twelve.

Reservoirs are easily and cheaply constructed; they are made by throwing up embankments of earth to the height of from six to eight feet, then the water is pumped in and cattle or horses are turned in and driven about until the bottom and sides are thoroughly puddled, sometimes heavy clay is hauled from some clay bed or bank and thrown over the bottom and sides. Again, the farmers hitch their horses to a drag or scraper and drive the team around within until the bottom and sides are securely packed and made water

tight.

Some farmers in Nebraska have attempted to utilize about all that can be obtained from mills and pumps. water is first run through the creamery box, thence through the watering trough in the stock yards, thence to the first reservoir from which they intend to cut their ice in winter, thence to a second reservoir where fish are grown, and often a small bathing house is set upon the edge of this reservoir where the youngsters of the family can disrobe and bathe during the summer season. On some of these miniature lakes small boats are found where the youth of the family can commence training preparatory to a more extended course at Harvard, Yale or Cornell. lilies are planted in some in order to check the evaporation. The cost of these irrigation plants is not great where the water is not lifted to any great height, the cost varying from \$4 to \$6 per acre per the irrigating capacity of mill and pump where water is not lifted over sixty feet, yet plants are doing good work and irrigating as high as ten acres, pumping from the depth of 150 and 200 feet both in Kansas and Nebraska.

THE PIONEER IN THE RAISIN INDUSTRY.

LESSONS FROM THE LIFE OF A CALIFORNIA FRUIT GROWER.

By FRANK S. CHAPIN.

BY exaggerating the real evils of farm life, and dwelling upon imaginary ills there has been caused a congestion of population in cities, abandonment of farms and consequent decline of citizenship and public prosperity.

Not all farmers are wrecks from other trades cast upon the shore of that calling where it is thought that any one can make a living, nor do all weary the body, dwarf the brain, and bury the soul in the tread-

mill of daily toil.

The California farmer who would avail himself of the wondrous possibilities offered by our climate and conditions must be a close student of the alchemy of nature, and to attain the best results must have a broad conception of the laws of trade.

He who visits the home of the late Dr. Blowers, of Woodland, California, will not wonder that Mt. Vernon had such charms for Washington or Ashland for Clay. In view of the importance of elevating productive industry as a means of increasing public prosperity, it is a question whether equal talent devoted to the creation of model houses at Mt. Vernon and Ashland and to spreading knowledge calculated to awaken like aspiration in others might not have been as useful to the country as the wonderful careers that those great men lived.

In 1851 Dr. Russell B. Blowers came to California and like other professional men began mining. After three years he bought a small farm in Yolo County, and soon moved to a larger one four miles south from Woodland. After farming a quarter section for ten years he concluded he had too much land and moved to the eighty acres near Woodland which he afterward developed to such a high state of cultivation.

In 1857 he began to raise grapes, and in '63 he secured from an importation by Arpoad Harazthy, the famous muscatella Gordo Blanco grape with which his reputation as the 'Father of the Raisin Industry' was founded. In 1868 he began

under an oak tree to pack raisins for market and steadily improved until he was able, in 1876, to take first honors at Philadelphia in competition with the world.

He was the first to introduce the form for packing London layers whose movable bottom enables the packer to face in such a way as to present a perfectly even surface to the eye. He was the first to introduce fancy printing to compete with

the Spanish style of packing.

In 1875 he had a car-load of raisins caught in a storm and cured them in the Alden evaporators at Vacaville. That machinery was calculated for curing fruit at high temperatures, but his experience there suggested the principle to him upon which his invention of next year was founded. This gave a rapid circulation of dry air at a temperature not higher than 120°. Under his careful manipulation this process developed a raisin that was hard to tell from those cured in the sun.

The invention was patented in 1877. Its essential features are a zigzag current passing under each tier of trays uniformly, and devices for the entry of air from hot air chamber, its escape by the flue and control by the blower in such a way as to secure an upward or downward current at will. The majority of raisin-dryers built afterward embodied more or less of his ideas, but he was so much interested in the development of the industry and the country that he never took action to secure the royalty to which he was entitled.

When the dryer was a demonstrated success, he turned his attention to the subject of irrigation. He thought that the sand streaks where his walnut trees failed to grow and the palms and yuccas thrived was once the channel of Cache Creek, the inlet of Clear Lake, and still marked the course of an underground current. A well twelve feet across and twenty feet deep supplied a centrifugal pump to irrigate his eighty acres of trees and vines. To flood alfalfa he still used the waters of the ditch which had for years been at his disposal.

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DR. R. B. BLOWERS.

The advantage of the pumping plant rests in command of a water supply at any time needed, and the certainty that no weeds will be distributed by the irrigating water. The fire box in his boiler is calculated to burn straw, peach pits, almond shucks, brush and all the refuse which accumulates so rapidly on a large fruit ranch.

The accompanying engraving shows a part of Dr. Blower's family sitting by the yucca that thrives where the walnut trees died, and the top of the dryer and the big tank in the background. From the smoke we judge that either the blower or the pump was in active motion. Both are run by the same engine.

From 1880 to 1886 Dr. Blowers was a very active member of the viticultural commission. Some difference of opinion proceeding in part from his conception of the duty of a State officer to deal impartially between localities and to expend judiciously all funds of the State, finally caused his withdrawal from the commission.

The controversy, as published in the Yolo Mail, of March 27, 1884, the S. F. Merchant, of March 7, 1884, and other publications, reflects great credit upon the sincerity of purpose and discrimination of Dr. Blowers and will prove interesting for

reference so often as the subject of retrenchment comes before the Legislature. Industries seeking appropriations need to give a very clear account of their stewardship.

At school he learned of the laws of pneumatics and so continued his studies and applied the principles as to design one of the most comfortable homes anywhere, to act as a pioneer in the artificial curing of raisins and in the later years of his life to develop a plan for transportation of fresh fruit overland without the bulky and costly method of refrigerating by ice. This was carefully outlined in the Pacific Rural Press of December 29, 1893.

Several investigators are following in the wake of his valuable suggestion and we hope to have very soon in successful operation a method of shipping fruit that will land the products of orchards and vineyards in eastern markets in practically the same condition they left home, at little over half the present cost of transportation. Now we carry about as much weight of ice as fruit. Those promoting improvement along these lines have special cause to regret the loss of our friend at the very zenith of his mental activity.

Although a pioneer in many lines of industrial improvement, and so persistent that almost every one of his ideas was brought to the point of success, this story will show that the last year of his life was more fruitful in practical suggestions and was opening up a wider field of improvement than any other.

Miss Austin, Mr. T. C. White and many others who made brilliant reputations in raisin culture, at Fresno, received from him their first cuttings and elaborate



THE BLOWERS' DRYER.

practical directions for their management.

At Riverside they had many a trouble with their raisins, and hearing of Dr. Blower's success they wrote so many letters of inquiry that he finally expedited matters by visiting them at their homes and addressing them at their meetings. From this visit they date their era of suc-

cessful raisin production.

His prominence in the raisin industry was such that many forget that he was a leading shipper of fresh fruits. most as soon as the Overland was open for traffic he began shipping grapes and in 1869 sent a car-load to Chicago. Shippers will be amused to hear that the first lot went in an ordinary freight car, each bunch enclosed in a paper sack and packed in twenty-pound boxes. Intending to give all varieties an impartial test several boxes of Sweet-waters were included in this lot. Since then the lateripening, long-keeping and fine-carrying qualities of the Emperor has made it his chosen shipping grape. Cars of Emperor and Tokay have reached New York in good order after twenty-one days of travel. They had strayed, by mistake, through Kentucky and Tennessee and several other states. Some of the early shipments netted a left-handed profit of \$2,000 per car.

Not many years since it was supposed that all shipping grapes had been ruined by a rain of six inches. He packed 480 crates of Emperors, and ran them into the dryer long enough to get rid of the dampness. They reached so hungry a market in such perfect condition they brought him six dollars and ten cents per crate and more than made up for the loss resulting from the disaster in his early ship-

ments.

Every year elements of risk are being removed and the shipment of fruit approaches nearer to a staple industry. There remains much to be done to secure so direct and economical a contact between producer and consumer as to distribute the possible output of California where it will find a satisfactory demand.

HANDLING AND MARKETING FRUIT.

In 1884 Dr. Blowers was eastern manager of the California Fruit Union and active in establishing the auction system for disposing of fresh fruit on arrival.

The illustration herewith will give a

better idea of the system than paragraphs of description. To win in handling fresh fruit it is necessary to reach the consumer promptly. After a long trip overland it often gets caught by a fresh shipment while waiting in the rooms of the dealers, great and small, to reach the consumer, in the regular course of trade. Many plans have been made to control this business by special advantages designed to create monopolies. Dr. Blower's influence was always in the direction of such a free distribution that each dealer would share in all the advantages it was possible to give in proportion to his trade and facilities and that all shippers should have benefit of information coming to the Fruit Union.

The experience of last season emphasized the necessity of an organization to execute the designs of the Fruit Union and it is to be hoped that those who have had most experience will join with the Fruit Exchange, and with a following in proportion to the present importance of the business proceed to improve upon the plans originally designed by the Fruit Union for the benefit of the industry. The evils of sending three cars where one is needed and leaving other markets for days without any supply are more easily

seen than remedied.

The point has been made that only five millions of the people of the U. S. ever have a chance to buy California fruits and that it is desirable to send regular supplies to interior towns that can take less than car lots and have had only small lots

at long prices by express.

This opens a field for more persistent effort than railway officials are likely to bestow and needs a worthy successor to our friend to work for the interest of producers. Railroad men could distribute small lots of fruit as easily as they manage the oyster trade if the matter appealed to their pockets as it does to those of producers. So long as the roads have all they can do to carry fruit to main distributing centers there is small hope that they will try plans to cause the demand to keep pace with the supply. With more cars and more roads they will find a way to reach more points.

During '93 Dr. Blowers took a leading interest in a plan to make the natural facilities of Yolo County available for irrigation and power. He wrote many articles for the Woodland papers that

called out opposition from Lakeport editors who supposed their interests were in danger. Some of their leading men discussed the subject with him personally and learned that it was no more harmful to them to have Yolo use the water power from Cache Creek canyon than to breathe the zephyrs that had once fanned their native Switzerland.

AN ABUNDANT WATER SUPPLY.

Clear Lake has an available water supply of 435, 360 acre-feet with 1, 200 foot fall between its outlet and entry to Cupay Valley at Rumsey. The watershed of the canyon

sation which would release their capital for other investments and enhance value of their remaining property.

Present and prospective prices of wheat offer little inducement to extend that industry and the decreasing fertility of the soil shows effect of steady cropping.

soil shows effect of steady cropping.

Water brings alfalfa. That dives deep into the subsoil and reaches into the air for its nourishment and restores the humus to the soil. Irrigation will also introduce the varied industries of intensive farming and make small holdings profitable under conditions where no crop is lost and no stock goes hungry.



TWIN CITY FRUIT AUCTION ROOM AT ST. PAUL, MINN.

is more than that of the lake and after a liberal allowance for losses there remains 115,463 horse power. Estimating the value of this at 10 per cent of the cost of wood or coal to generate like power gives an annual rental value of \$731,945 provided all could be utilized.

To accomplish this Dr. Blowers suggested the formation of a Wright-District to irrigate some 300,000 acres and also to develop and distribute the water power. Certain vested rights of present ditch owners are opposed to this but the suggestion contemplated reasonable compensations.

In the last ten years, statistics showed that Fresno County, Cal., alone, had gained more in population than the whole Sacramento Valley and it was because of irrigation and intensive farming.

By distributing the water power from Cache Creek canyon by electric transmission over the farms of Yolo it could be made to do a great part of the work now done by horses. In that case it was estimated that one-third the land, the part now necessary for sustaining the animals that do the work would be available for the support of human life. At that rate

70,000 more people would find a living there so soon as such power was used for all the land these waters would irrigate. As soon as the county developed in this way villages would grow into cities; blacksmiths into machinists; retailers into wholesalers; schools into colleges; and colleges into universities.

To preserve this opportunity until the people should be aroused to the importance of action, Dr. Blowers not only thought, spoke and wrote, but although seriously ill he could not be dissuaded from attending the Los Angeles Convention of '93 when he felt that there was danger that Congress would be asked to turn over arid lands and reservoir sites to the States and make it possible for Legislatures to take such action as would place the opportunities of the many under the control of the few.

When action was pending in the Legislature designed to complicate action by declaring the lake the property of Lake County he telegraphed a request to the governor that he withhold his signature until a Woodland delegation would reach him, and this friend of the people rose from his death-bed, long after he had ceased to attend to any private affair, to solicit his fellow citizens personally, to wait upon the governor and use their influence for their county in that crisis.

Not often do we find one, upon whom no official responsibility rests, so zealous for the public good as to place others' interests before his own even to the last day of his life.

He spoke of approaching death as a pleasant journey, and well he might. For one who has lived so much for others knows what the preacher meant when he said: "It is only three steps to Heaven; out of self—unto Christ—into glory."

By precept and practice he was a firm believer in intensive farming, and held that the development of the country rested upon small holdings of irrigated land. He claimed that ten acres of good land, well cultivated, would employ and sustain an average family on a scale of comfort to enable them to live as intelligent, self-sustaining, public-spirited citizens.

His first prune orchard was seven-eighths of an acre. The first five years after it came into bearing he marketed 5,700, 6,700, 7,700, 8,700 and 7,200 respectively. being an average of 7,200 pounds of mer-

chantable prunes for a term of five years. He estimated that ten acres of such land as his would produce 100 tons of alfalfa hay annually or keep twelve cows, ten hogs and 200 hens. If devoted to sugarbeets it would produce 300 tons. On his own home ranch are kept a dozen cows, twenty or thirty dozen chickens, forty to fifty hogs and eight horses.

The balance of the place, not required for stock, is planted with seedless raisins and shipping grapes, olives, prunes and apricots. Many of these are young trees, planted between rows of vines, so soon as he foresaw the effect of free-trade upon the

raisin industry.

To colonists he would recommend the care of stock and fruit so distributed as to keep working members of the family always occupied, but never crowded. irrigated land and small holdings they would be close enough together to have common drying grounds, fruit-shipping stations, creameries, canneries, etc. Each family could have milk and eggs to send to the creamery every day, could have flowers and vegetables to use and spare, and when fruit harvest came could have pears, peaches, prunes, apricots or grapes, figs, almonds, olives, oranges or lemons to With products to market that bring cash every day they would be in a position to buy for cash and avoid the system of credits that has proven the ruin of many new settlers.

For several months Dr. and Mrs. Blowers represented the State Board of Trade upon "California on Wheels," and met many in the east whom they had entertained during excursions of representative bodies to California. All were greatly interested in the exhibit.

The present world-wide depression has so affected prices that the low margin of profit generally connected with safe business, affording constant employment, has temporarily been upon the wrong side of the ledger. Some reason that existing conditions are likely to become permanent and that the farmer of the future will become a peon. Conditions have never remained the same for any term of years in our history, and it is only by averaging results of decades that we can reach safe data from which to estimate prosperity of a vocation.

Accounts show that for the twenty-six years Dr. Blowers farmed his eighty-acre

home ranch he paid out for labor upon it \$80,000. This was almost forty dollars a year upon each acre.

The subject of our sketch never speculated, nor did he take advantage of the many opportunities for profit that came to him on account of his reputation. He was welcomed to all assemblies of representative Californians as among the most intelligent and public-spirited of their number. He trained his children to appreciate and practice the education and refinement of the best city homes and to be thoroughly practical in all the details of his many-sided business.

On one occasion that came to the writer's notice Dr. Blowers was asked to join a syndicate to subdivide a tract designed for a colony of raisin growers. The endorsement of his personal recommendation and his supervision were to constitute his share of the investment, which was likely to net him more than the accumulations of his lifetime. He examined conditions of soil and climate and concluded that, while a good showing might be made for a time, the colonists could not successfully com-

pete with more favored localities in the close race of the survival of the fittest that he foresaw. For this reason he withheld the use of his name.

He has been regarded as a boomer among Californians, and boomers have been looked upon as devoid of conscience. Here was a fortune refused rather than mislead investors.

The genial influence of his personality so pervaded his household that people who have enjoyed its hospitality for years never dreamed that his present wife was not the mother of the children, and he saw no need for any other provision in his will than that all should share alike in the magnificent property he left them.

If ever a life proved a theory this one proved that education is not wasted upon a farmer. The fool may make a living on a farm, but that living is better termed existence, while the man of thought may live so near to nature and in such sympathy with his fellow men that the living may be one continual joy to himself and a benediction to his race.

RECENT DECISIONS UPON THE SUBJECT OF WATER RIGHTS.

BY CLESSON S. KINNEY, OF THE SALT LAKE CITY BAR.

RECENTLY in the Supreme Court of the State of Colorado in the case of White vs. Farmer's Highline Canal and Reservoir Co. (43 Pac. Rep. 1028) it was decided that: The taking and use of water for irrigating purposes is a matter of public interest and subject to state control; and that the irrigation act of that state regulating the taking and distribution of water from streams, and providing among other things that each company controlling canals or ditches shall appoint a superintendent who shall measure to each person entitled thereto, his or her pro rata share of water, applies to and governs companies carrying water for hire and also their patrons, and one consumer cannot ignore the allotment made by the superintendent and appropriate to himself more water than his just share.

It was also held in the same case that the law regulating water rights being in the exercise of the police powers of the state is paramount to a private contract though such contract antedates the passage of the law and rights given by the contract must yield where they are in contravention of the provisions of the statute.

LICENSE TO CONSTRUCT DITCH.

In the case decided Feb. 17, 1896, of Tynon vs. Despain et al. by the Supreme Court of Colorado (43 Pac. Rep. 1039) it was held that a parole license to construct and maintain an irrigation ditch over the lands of the licensor when executed by the construction of the ditch is not revocable; and that in an action to recover for damage to an irrigation ditch by its being broken and the water diverted

by the owner of the land over which it passed, the defendant cannot, under a general denial of plaintiff's rights to maintain the ditch, introduce evidence of its enlargement or of its want of uniformity of grade.

RIGHT OF WAY FOR DITCHES OVER GOVERN-MENT LANDS.

In the same case as last above cited it was also held: That the revised statute of the United States, § 2339, enacted in 1866 providing that whenever by priority and possession water rights have vested and accrued under local customs, laws and decisions of the courts, such rights shall be maintained and protected and right of way for canals and ditches for such purposes is acknowledged and confirmed, together with the amendment of 1870, § 2340, providing that all patents granted or pre-emptions of homesteads allowed, shall be subject to any water rights or rights to ditches acquired under, or recognized by § 2339, operate as a grant of the right of way for the construction of irrigating canals or ditches over any lands owned by the United States and unoccupied in 1866 whenever the right to build such ditch should accrue under the local customs, laws or decisions of courts, and that such right continued so long as title remained in the Government, subject only to payment of damages to the possessory right of the occupying claimant, stipulated for

in a proviso of § 2339 which reads as follows:

"That whenever, after the passage of this Act, any person or persons shall, in the construction of any ditch or canal, injure or damage the possession of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage."

It was also held in the same case that the sections of the United States statute above referred to, are a recognition of the legality of water rights given by local customs and laws, and lands granted to the Pacific railroads continued subject to the rights and easements given to such customs and laws, including the right of way for irrigating ditches; such rights being embraced within the reservation of "and other lawful claims" contained in the Act of July 2, 1864, subject to which said grants were made.

CONVEYANCE OF LAND BY PATENTEE SUBJECT
TO THE ABOVE EASEMENT.

And also in the same case it was held where an irrigating ditch is constructed over lands while the title thereto is in the United States and the occupant whose possession afterward ripens into a patent, conveys the lands, the grantee takes them subject to the easement of the ditch although no reservation is made in his deed.

CHEAPER POWER FOR SAN FRANCISCO.

BY W. C. FITZSIMMONS.

ONE of the greatest needs in San Francisco is cheaper power. With abundance of cheap power at command, numerous industries not now thought of would without doubt spring up on all hands. A wise merchant invites trade by displaying goods in his show windows. It is thus that millions of dollars worth of goods are sold at large profits which would never have been sold at all unless thus shown to be in stock. So it will be in the manufacturing line. When power, cheap and abundant, is "on tap" and may be had by touching the button, the demand for it will increase incredibly. But first-class coal is, and prob-

ably will continue to be dear in San Francisco and in fact throughout California. Our oil fields though extensive, are not known to be capable of furnishing a permanent supply of fuel for steam purposes. Wood for fuel on the large scale required for extensive manufacturing enterprises is out of the question; it therefore becomes imperative that other agencies for producing-power be utilized. Fortunately none of the large cities of the country, except Buffalo perhaps, is more advantageously situated than San Francisco for profiting by electrical power derived from water falls. The recent triumph scored by Sac-

ramento in bringing over the wires thousands of horsepower of electrical force derived from a waterfall in the American river twenty-two miles away, has been an object lesson worth millions of dollars to San Francisco if that city shall have the enterprise and foresight to fully utilize the lesson thus to be learned. While it may or may not be a commercial proposition to bring the Sacramento electrical power to San Francisco, by reason of the distance, yet it is practically certain that an immense power may be derived from a great waterfall nearer to the city. In Lake County, about ninety miles north of San Francisco, lies a large body of fresh clear water, twenty-six miles in length by eight miles in breadth and 140 feet in extreme depth. It is 1.350 feet above the level of the sea. The lake is fed by perennial springs and mountain streams, and has an outlet known as Cache Creek which in the first few miles from the lake falls more than 400 feet, and finally flows into the Sacramento river in Yolo County. Competent engineers allege that electrical power may be transmitted ninety miles with a total loss of only twenty-five per cent of the dynamic force of the waterfall.

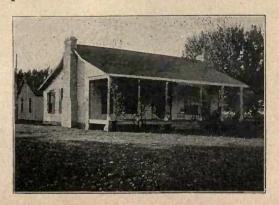
Thus we have at our very doors, so to speak, a power capable of transforming San Francisco into a great manufacturing center not surpassed by any other city of its size in America. And all this, too, without in any way detracting from its beauties as a most desirable place of residence, for of course the soot and smoke of countless chimneys would be conspicuously absent. In short, we have everything that reasonable man could ask to make San Francisco and the towns and cities surrounding, hives of industry and thrift. Besides all these natural advantages we have more than a hundred million dollars in the savings banks of San Francisco alone, to say nothing of the millions of unemployed capital lying on deposit in other banks.

What then, remains to San Francisco and the bay cities to enable them at once to enter into their rich and natural inheritance? Simply enterprise, and sufficient civic pride to make full use of the prodigal gifts which nature has ungrudgingly bestowed. All preliminary work has been done and the Clear Lake Electric Power Company has been organized to do the things above outlined. But the company should be backed by ample home capital, and a spirit of enterprise must be shown, else it will be necessary to enlist outside aid in this grand work of development for the benefit of California. But it must be The hour has come when to defeat or long postpone so great a work would be unspeakable folly, not to be thought of for a moment by those having the good of the bay region at heart. The response of our local capitalists to the call for aid in developing and utilizing the Clear Lake Electrical plant will go far to determine the measure of their enterprise and civic pride and it is hoped that when fairly presented to them, the money will not long be lacking for the installation of a gigantic power which will make the name of California a synonym for progress throughout the In this connection the following extract from the report of Col. O. E. Moore to the Manufacturers' and Producers' Association of this city relating to this subject will be found of great interest:

"The magnitude of this project and its value to San Francisco can hardly be estimated. Power in almost unlimited quantity can be transmitted to the city at one-third the cost of steam power at the present price of coal and the saving to manufacturers in one year will about equal the cost of the plant.

This is in my judgment the first time a practical and economical plan has been presented to solve the problem of cheaper power and I cordially and earnestly recommend it to the Manufacturers' and Producers' Association for their coperation and support. It is one of the most inviting fields for a very profitable investment

of capital that I have ever seen."



THE DIVERSIFIED FARM

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WHAT TO GROW ON THE IRRIGATED FARM.

BY F. C. BARKER, OF NEW MEXICO.

WHAT is the best thing to grow? is a question often asked, but very seldom satisfactorily answered. The usual advice is to grow what there is most money Sometimes there is a rage for peaches, at other times for alfalfa, with the usual result, that whatever crop is popularly believed to be the most profitable, is usually overdone and the markets glutted with an over-supply.

If a man is a working farmer, and understands his business, I believe there is always most money in raising what is consumed in the family, and herein lies the first advantage of having a farm under irrigation. It will always insure food for the farmer's family however small the

farm be.

The first consideration, therefore, should be to see that the family is supplied with flour, fruit and vegetables. Wheat may not be profitable as a market crop, if grown on a small scale, but better raise it yourself than pay some one else to do it for you. Besides you probably save freight or hauling and the profits of two or three merchants. The same may be said of corn, which has the advantage of being raised the same year after wheat in many irrigated countries of the South. The fodder will also make very useful feed for stock if a corresponding proportion of alfalfa is fed with it.

Alfalfa is a crop that should never be omitted on an irrigated farm. It will supply more food for hogs, cows, horses and poultry to the acre than anything I know of, and is a sure cropper with plenty

of water.

With the crops already mentioned a farmer should insure a regular supply of eggs, milk, butter, poultry and bacon, and

have something left over to sell.

But I am aware that this advice, although perfectly sound, will not satisfy the average farmer, who is always hankering after something that there is money in.

Well, on this point I think it good policy to grow that which cannot be successfully grown without irrigation. In my experience those are the crops which usually pay the best in the long run. This is what makes alfalfa such a paying crop. On no other food can bacon and milk be so cheaply raised, and if it were not for the fact that it cannot be grown without irrigation, no farm in the world would be without its alfalfa field.

Celery and strawberries are two other cheap crops which, except in a few favored localities, do much better with irrigation than without. Several strawberry growers in the East have made up their minds that, even where the rainfall is excessive, artificial irrigation is necessary to insure regular crops and they are putting up windmills and other devices for pumping water. I believe the day is not distant, when very few strawberry growers will risk the loss of their crops by droughts, and they must necessarily go to a great expense if they have to pump the water. This expense is saved on the farm furnished with water from a canal. A good principle to follow in business is always to stick to some line in which you have special advantages. Don't do what every fool can do. Do not be led away with the idea that there is a fortune in lemons, or in almonds, or in olives. The natural law of supply and demand tends to reduce the profits on all crops to a level, and what to-day looks the most profitable, will tomorrow be the most unprofitable. But grow what you are best situated and fitted for and you will hardly ever make a mistake.

ONE HUNDRED AND FOUR BUSHELS OF CORN PER ACRE.

[F. D. Coburn, Secretary of Kansas Department of Agriculture, furnishes the following timely article.]

MR. J. A. BAXTER, of Waveland, as high as 104 bushels of shelled corn per acre in 1895, furnishes the State Board of Agriculture the following account of it,

together with some of his corn-raising

methods in general:

"The portion of my crop giving a yield of 104 bushels of husked, well-dried (fifty-six pounds, shelled) corn per acre was five acres of fifty-seven I planted last year. My land is slightly rolling prairie and about a fair average of Kansas soil, with a hard, impervious subsoil. The five acres mentioned were at one end of a twenty-five-acre field, part of which had been in potatoes for two years and the last crop dug with a listing plow late in October, which was equivalent to a deep fall plowing.

"In spring the ground was much like a bed of ashes. It was then deeply plowed, made fine and smooth with a plank-drag and drilled the first week in May with a 'Farmer's Friend' planter of medium width, with a deep-grained yellow Dent corn; about the same quantity of seed was used as would have been if from three to somewhat less than four grains had been placed in hills the ordinary distance apart. This was cultivated four times with common gang cultivators and hoed three times—the last hoeing after it had been

finished with the cultivators.

"I am a strong believer in deep and thorough cultivation, and long since learned that a good crop of corn and a rank growth of cockle-burs, crab-grass and similar weeds cannot occupy the same ground at the same time. I have not subsoiled for previous crops, but last fall invested in a Perine subsoiler and used it on fifteen acres. I intend planting 100 acres in corn this season and aim to have it all subsoiled. Am subsoiling my fields the narrow way first (they are from forty to eighty rods wide and 120 rods long) as deeply as four horses can do the work, at distances of two and one-half feet. then throw up the ridges cross-wise of this with a listing plow, following it in each furrow with the subsoiler as deep as three horses can pull it, and drill the seed immediately in the track of the subsoiler. This will leave the land subsoiled in both directions.

"My whole crop for 1895 averaged only fifty-seven bushels per acre, yet would have made seventy-five bushels but for an unfortunate invasion just at the critical time by an army of chinch bugs from an adjacent thirty-acre field of oats. With proper treatment of our soils and

thorough cultivation I am of the opinion that in all favorable seasons such as last we should raise from seventy-five to 100 bushels of corn per acre instead of the more common twenty-five to fifty bushels. I am always careful to avoid cultivating when the land is very wet, and think many farmers make a serious mistake by working their corn when the soil cleaves from the shovels in chunks. The sun is likely to then bake the ground and the growth loses its bright, healthy green and turns a sickly yellow."

SUGAR TO REPLACE WHEAT AND COTTON.

BY W. C. FITZSIMMONS.

FROM the Florida Farmer and Fruit Grower we take the following:

"We pay annually about \$125,000,000 for foreign sugar. It should all be made here. The sugar-beet crop should take the place of wheat on the great prairies where farmers are in poverty because wheat no longer yields a paying crop, and the cotton fields and the reclaimed glades of the South should be turned into cane fields where they will produce from \$50 to \$100 per acre without bounty."

The above is in some respects a misleading statement; especially that part of it relating to the feasibility of planting the wheat fields of the North and the cotton fields of the South with sugar-beets or cane in the hope of realizing \$50 to \$100 per acre for the crop. It is impossible. Such results have scarcely yet been assured by the best land in the world, when planted on so large a scale, and cannot be on the worn wheat and cotton lands of the North and South.

The total importations of sugar are enormous to be sure; and for the year ending June 30, 1894, amounted to 4, 261,-360 004 pounds, valued at \$124,720,681. For the previous fiscal year the imports were 3,731,219,367 pounds, valued at \$114,959,870. While it is certain that this immense quantity of sugar can be and should be produced in the United States, it should be also remembered that all land is not adapted to sugar beets or to cane. More than 20,000,000 acres are annually planted with cotton in the United States and the yield averages less than 200 pounds of lint per acre, worth last year about \$10.90. The 34,000,000 acres of land planted with wheat last year yielded but about thirteen bushels per

acre, worth less than \$6.50 per acre at the farm. It is manifestly impossible for land either North or South which yields only thirteen bushels of wheat or 200 pounds of cotton per acre to produce beets to the value of \$100 And experience Caliper acre. fornia, Nebraska, Utah and Virginia shows conclusively that the best beet land in cultivation in most of those States does not give the returns announced by the Florida Farmer. But an average of thirteen tons of beets per acre which sold at \$5 per ton during the life of the bounty law is the highest product ever reached in this country and probably in the world on large areas. Thus, while sugar production should be encouraged by all legitimate means, it should not be stimulated by holding out inducements impossible to realize. But let the sugar industries be built up! There is ample room for them to flourish.

PRACTICAL FRUIT AND VEGETABLE IRRIGATION.

JOHN TANNAHILL, of Columbus, Neb., in a recent speech before the Horticultural Society, gave the following

as the result of his work:

"From an orchard of apple trees, of which 190 are beginning to bear, I got twenty bushels of apples in 1894, and this year I got from the same trees over 300 bushels. The trees are twenty feet apart; water is run between the rows, and I find that it does not take nearly so much water this winter as it did last, for the reason that the subsoil has been moist since last winter. As an experiment, I left some apple, cherry and apricot trees unwatered last winter; those apple trees not watered were in bloom just six days before those that were watered, with the exception of one tree that I mulched, which, after watering, was six days later and was loaded with fruit. The spring frosts hurt some of those that were watered, but, as they were not overloaded, the fruit was much larger and very superior to that of the others. Of those trees not watered two died and seven had some fruit to set, but it kept dropping until time of ripening, when there was but very little of it left, and that was poor, almost worthless.

cherry trees, ninety-three of which I watered, bloomed two days later than those not watered, and all were heavily laden with large, juicy fruit, none dropping off or drying up; of the eighteen unwatered, ten died, eight bore very inferior fruit, hardly worth picking, and the trees made but six inches of growth of wood, while those watered made a growth of twelve inches. The cherry trees were watered during the last week of December, and received no water before or after; the apple trees were watered previous to this and when the ground was frozen. Water goes much farther and does more good in orchards if used in winter, but in no case let the water come into contact with the body of the tree, as freezing will injure it. Always have the ground a few inches higher around the tree.

AS TO VEGETABLES.

"I irrigated six acres for vegetables and made more profit off those six acres than off thirty acres unwatered. I grew from one-fourth acre that was watered three crops of cabbage, and the best part of it was that I got a good head of cabbage from every plant. At the same time I had two acres of unwatered cabbage, and I did not get one-fourth as many as from the one-fourth acre, and they were very poor. I plant cabbage two by four feet and water between the rows. The ground should be kept not only moist, but quite wet for them. When I see a cabbage beginning to head, I set a plant close by it, and when it is ready to cut, pull the roots and give room to the plant set a week or ten days beforehand. On all other vegetables on which water was used we were well repaid, as they were larger, smoother and of better quality, and the crop always sure. I have been in Nebraska twentyseven years and am satisfied that a practical man with five acres under private irrigation would make more money than from fifteen acres without irrigation; and no one need to be without it in our valleys, as we have plenty of water just a few feet below us, also plenty of wind above us, and by combining the two I believe we can irrigate more land than we can from rivers and creeks by ditches, believing that there is more water passing in the underflow than passes down rivers and creeks."

CAPACITIES OF WINDMILLS AND PUMPS.

Sizes of irrigation mills and pumps best adapted for each other to work successfully under ordinary conditions.

other to work successfully under ordinary conditions.								
10 FOOT MILLS.	+Size of Reservoir.		12 FOOT MILLS.	90x75 ft. Interlor dimen. 90x60 " " 60x40 " "		125x80 ft. interior dimen. 90x75 75x50 " " " 65x40 50x30 " "	*Amount of land that can be covered 1 foot deep with windmills working at the rate of 15 hours per day for 300 days in the year. Acres covered 1 foot deep, the per dayle of holing water for 24 hours confinious pumphing. These sizes should have 4 ft depth of water, height of bank 5 ft, withh of base 16 ft, 2 ft, of water below disharge pipe not included. These reservoirs to connect with additional reservoir by overflow pipe in order to utilize dual capacity of mills and pumps. Overflow reservoir should be of 1 and 2 acre capacity, 8 ft, deep, banks 9 ft, high, base of bank 45 ft., acre size 200 ft. on each side, corners rounded, 2-acre size 200x418 ft,	
	*Amount of Land Covered.			103 acres. 86 ". 37 ". 18 ".	14 FOOT MILLS.	146 acres. 1100 " 63 " 40 " 23 "		
	r Am't of Water in 24 hours.	87,840 Gals. , 61,920 31,680		180,000 Gals. 151,200 " 64,800 " 31,680 "		254.880 Gals. 174.240 " 100,880 " 71,560 " 40,320 "		
	Amount of Water per hour.	3,660 Gals. 2,580 1,320		7,500 Gals. 6,300 " 2,700 " 1,320 "		10,620 Gals. 7,260 " \$ 4,620 " 2,940 " 1,680 "		
	Am't of Water each Stroke.	1% Gals. 1% " 5% "		4½ Gals. 3½ 1½ 4 3½		61% Gals. 43% ". 23% ". 13% ".		
	Length of Mill Stroke.	10 inches. 10 ". 10 ".		12 inches.		14 inches, 14 " 14 " 14 " 14 "		
	Depth of Well.	30 ft. and under. 50 ". ". 75 ". ".		30 ft. and under. 50 " " 75 " " 125 " "		30 ft. and under. 50 " " 125 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " 175 " " " 175 " " " 175 " " " 175 " " " 175 " " " 175 " " " 175 " " " 175 " " " " 175 " " " " " 175 " " " " " " 175 " " " " " " 175 " " " " " " " 175 " " " " " " " " 175 " " " " " " " " " " " " " " " " " " "		
	Diameter of Pump Cylinder.	8 inches. 6 ". 4 ".		10 inches. 8 " 6 " 4 "		12 inches. 10 8 6		
	Size of Mill.	10 feet. 10 "		12 feet. 12 ". 12 ".		14 feet. 14 ". 14 ". 14 "	*Amount of +Capable of below dischar	

Estimates made on data taken from the U. S. Signal Station at North Platte, Neb. Least working power of wind estimated at 15 miles per hour.

An Object Lesson. - Two days after irrigating my acre patch of strawberries the other day I started my Mexican boy in with a wheel hoe to cultivate the soil. After doing about half an acre, which took him some six hours, he remarked to me in his native tongue, "Patron, it seems to me that this stirring of the soil will make it dry out much faster than if left alone." "I don't think so, José," I replied; "you hoe your chili after each irrigation. Why do you do it?" "Because it won't grow thriftily unless we keep the soil around continually hoed," "Yes," I replied, "it is he explained. because the loosening of the top soil preserves the moisture and lets in the air to the roots." To-day, nine days after the last irrigation, I took my Mexican to a patch of ground that had been left unhoed, and he was obliged to admit that at a depth of three inches it was much drier than the land he had hoed. To-morrow we irrigate the strawberries again, and when the Mexican hoes them, he will have the satisfaction of feeling that at any rate it is not labor lost.—F. C. Barker.

Antidotes for Alkali.-There are antidotes for all the different forms of alkali. The neutral alkali salts, common salt, Glauber's salt, sulphate of potassium, etc., are only injurious when present in large quantities, and must be washed or drained from the soil. There are but few localities where there are such quantities as here. The soluble earthy and metallic sulphates and chlorides, such as Epsom salts, bittern, chloride of calcium, alum, copperas, etc., find their antidote in lime, says a writer from New Mexico. Alkaline carbonates and borates, which are the most injurious, rendering the soil-water caustic and corrosive, find their antidotes in gypsum or land plaster.

The experience on my own land, where I am cultivating purposely the greatest variety of plants, shows that there will be practically little trouble in overcoming all difficulty from alkali. In fact there is scarcely a thing we have planted where it has been properly irrigated, which has not made satisfactory growth. If we find an exception it is almost invariably because water has been permitted to stand around the plant for lack of proper drainage, or in places where too much water has settled during irrigation, and this has been quickly remedied by providing the drainage.

Asparagus in the Garden .- A writer in the Montana Fruit Grower says that in his village there are four hundred gardens but only twenty asparagus beds. Writing of the little care necessary to have this delicious vegetable in ample supply for the family, he says: "Seventeen years ago I set an asparagus bed, ten by fifteen feet, using fifty plants in rows three feet apart. The ground was prepared the same as for an onion bed. For fifteen years that bed has been cut every other day, from its first appearance late in April until July 1. As soon as the last cutting is made, about four inches of fine, well-rotted manure is put on. No further care is needed, except to take out the weeds coming up from the manure. The tops may be cut and burned in the fall, or left until spring to retain the snow and prevent deep freezing. As soon as the ground can be worked in the spring, the manure should be forked in, being careful not to injure the crowns, which can be felt the moment the fork touches one.

An Important By-Product.-An Eastern fruit dealer saw a specimen of dried orange peel on exhibition at Los Angeles and had this to say about it: "That is the first lot of California dried orange peel I ever saw which comes up to the requirements of the trade, and that is as good as the very best I ever saw from Italy. peel is cut properly from point to stem, so that they are about an inch wide at the middle. The white is all carefully removed from the outer peel, and the goods are nicely dried. They are of a high, rich color, and perfect in all respects. In New York that peel is worth eighteen cents a pound, wholesale price. A great deal of it is used in making elixirs, cordials, bitters, etc. The refuse oranges of Southern California ought to be put through a proper press to express the juice, which will sell in large quantities in Eastern cities. Phosphates are all the go now, and orange phosphate is one of the most popular.'

Growing Celery.—The time for transplanting celery is now at hand. Probably the best variety for general crop is the Golden Dwarf, although the White Plume and many other kinds are recommended as their equals. If the plants have not been grown in a cold frame or out of

doors, they can be purchased from those dealing in vegetable plants. The ground for celery should be well prepared to obtain the best results. A soil that is rather damp, but not wet; a heavy loam containing but little sand, or a spot slightly approaching to alkali, will make a good place for celery, providing the land is rich enough.

Early varieties may be transplanted any time during June, while the late kinds will do well if not planted till the middle of July in most sections of the irrigated region. The plants should be removed from the bed with care, to prevent breaking the roots. To secure uniformity in growth and make cultivation easier, the plants should be of a similar size and set about fifteen inches apart when transplanted. They should planted in rows and irrigated during the planting by allowing a small stream to flow down the row where the plants are The treatment for two months consists in good cultivation and frequent irrigation.

Simple but Important. — The first three commandments in successful fruit growing are:

Thou shalt not use poor plants.

Thou shalt not set plants carelessly.

Thou shalt not use ground until well fertilized and thoroughly prepared.

Neglect these three things and all the woes of a careless grower shall be thine.

A Demand for Horses — There is getting to be a strong demand in England, and in other parts of Europe, for American horses. It is said that one dealer has taken contracts for the supply of 6,000 head for the omnibus and cab trade of London. These horses will be gathered in Missouri, Illinois, and Kentucky. Heavy draft-horses are also in demand, and the supply is becoming very short. These are pointers which farmers and stock raisers should not disregard.

A New Treatment for Eggs.— Dried eggs are being put upon the market. Fresh eggs are broken and churned by machinery, and the mixture is then evaporated to dryness. They are claimed to keep indefinitely in this form. When cooked with hot water, in various ways,

they are said to taste precisely like fresh eggs. It promises to become an important industry and evidently will not require an expensive plant.

Remove the Dead Shoots.— Professor Hyane, of the State University of California, and Professor George Husmann, of Napa, both advise that when vines have been frosted the frosted shoots should be either cut or broken off promptly. The reserve buds will then push out and often make a fair crop. If the frozen shoots are left, the frozen sap sours the wood and injures the vine.

A Killing Committee. — In an admirable paper read before the Knox County (Ill.) farmer's institute by James H. Coolidge, Jr., and full of practical

suggestions, he says:

"It has been suggested that there ought to be in every community a killing committee, whose duty it would be to make an annual round and order all unprofitable cows killed. That would include all cows which do not produce 200 pounds of butter in a year or its equivalent in milk. I think I can conscientiously commend that suggestion."

The Difference.—Miss Clover and Mr. Cowpea will drag nitrogen out of the air and give it to you. The fertilizer dealer bags it and makes you pay 16 cents a pound for it. The difference in price between dragged and bagged nitrogen may represent the difference between profit and loss, says The Rural New Yorker.

Length of Corn Roots.—Professor King, of the Wisconsin experiment station, estimates that all the roots of a healthy corn plant, if laid end to end, would equal one mile in length. The root development measures the leaf development. I have usually found small ears on stalks with small root development, and large ears on stalks with large root development.

Keep your chickens out of the water-trough where they drink.

Thorough preparation of the seed bed saves time and cost in the after attention.

Where you find better stock you are

sure to find better breeding or better feeding.

Salt is an essential constituent of the blood. Cattle should be supplied all they will use.

An acre of good alfalfa will furnish pasturage for ten or twenty hogs per season.

Prairie or sward land ought to be thoroughly subdued before trees are planted in them.

Never use fresh manure on onion ground just previous to planting. It will give you a weed crop too quickly.

Wide tires on your wagons will make lighter draft for your teams and will improve rather than injure the roads.

The little scratching hen adds to the wealth of the country every year in eggs as much as the output of both iron and wool—\$135,000,000.

The fruit raiser who provides for the production of his own home supplies of all kinds of farm and garden produce will be the more independent.

Alfalfa should not be planted in an orchard. The roots go deeper than those of fruit trees, and the growth will be retarded if the trees are not killed.

Getting the corn ground ready is one of the big jobs in the corn states each year, and it has to be well done every time if good results are to be expected.

If sheep are dipped a few weeks after shearing, it will more than compensate the cost by an improvement in the weight and quality of the wool, and in the better health and comfort of the animals.

Cut alfalfa just after it has completed the full bloom and before it has begun to turn yellow near the ground. Irrigate just before cutting and harrow immediately after if you wish to get quick recovery and perhaps cut an extra crop in the season.

According to the American Cultivator forty million eggs are use by the calico print works each year, photographic establishments use millions of dozens, and wine clarifiers call for over ten million dozens. The demand from these sources increases faster than the table demand. They are used by book binders, kid glove manufacturers, and for finishing fine leather.

MAXIMS FOR THE IRRIGATED

If you starve your land it will starve

you.

Frequent cultivation helps out irriga-

The rougher the surface the longer the

Poor roads cost most and are worthless always.

Stunt a calf and it becomes a poor investment.

Adversity may bring blessings, though disguised.

A manly man meets and overcomes difficulties.

It is the attractive goods that command best prices.

Fruit is one of the best medicines, and the cheapest.

Do your best and you need not fear consequences.

There is a right way and a wrong way to do everything.

Many start all right but do not hold out as they begin.

A single weed may furnish seed to stock Don't let it. a farm.

Fruit growing is not a business to be undertaken by mossbacks.

Turn the soil early in the fall and plant it early in the spring.

If you send inferior stuff to market you cannot hope for high prices.

You can't live long enough to learn all there is to know about farming.

If you cannot know but one thing it is better to know that thoroughly.

It is one thing to know what ought to be done, and quite another to do it.

The best machine for the conversion of corn into money, is a well-bred hog.

Think—Can you tell why there are so many gray horses and no gray colts?

Buy shoes at the close of the day when your feet are at their maximum size.

It is not good sense to breed a class of animals for which there is no demand.

Flowers, in doors and out, are the most attractive of all forms of ornamentation.

Those who loaf at the store and whittle are not the fellows who raise good crops.

The little things that farmers cannot find time to do are sometimes most important.

The alfalfa farmer of the west makes many blades of grass grow where one grew before.

Diversified crops, careful attention, patience and perseverance contribute to success in farming.

Save it all and make the most of the farm manure; it is an important resource; to waste it is criminal.

It is the food it eats that keeps the animal warm. If fed in the open air it takes so much the more fuel.

A farmer cannot know too much about his farm, and he ought also to know something about the markets.

It takes a very conscientious man to hold to the straight and narrow path when the pocket nerve is involved.

It is not a prudent farmer who wastes the feed in winter which it has cost so much labor in summer to produce.

Rotation of crops is one of the best preventives against the spread of the various pests and worms that feed on different farm products.

It is a patent fact that reading farmers are as a rule the prosperous ones. Reading stimulates thought, and the more a farmer thinks, the bigger his crops will be.

Your grandfather might have been a good man and your father before you, but times now and then are different. It is the present to which you must adapt yourself.

Andrew Carnegie, speaking to the Cornell students advised them that the wise man would put all his eggs in one basket and then watch the basket; in other words adopt a specialty and get to understand the one thing perfectly.

THE PROGRESS OF INVENTION

A NEW machine for making cans turns out 120 a minute, or 72,000 every ten hours, with one man and five boys to attend it. The cost is but a trifle in addition to the first cost of the tin.

ELECTRIC locomotives have shown themselves to be fifty-five per cent cheaper in coal consumption than steam locomotives.

Tesla claims that his phosphorescent light is so closely a duplicate of sunlight that it can scarcely be distinguished from it. It possesses all the health-giving qualities and drives away dampness. The light is already an acomplished fact.

A New Jersey man raising vegetables for the New York market has spent \$25,000 in electric culture and facilities, and it is said he has increased his production from 40 to 60 per cent.

The latest design for a fire extinguisher is a quadricycle, or two tandems coupled together. They carry the extinguishing liquid and a supply of hose between the two and are operated, including the run to the fire by four men. It can beat a horse outfit getting there.

Santa Barbara, California, is trying a new form of street paving for which it has all the materials at hand. They have an asphalt mixer that uses wet sand. A crusher, on the other side of an oil-burning engine, crushes the rock from the beach. A compound of crude and refined asphaltum is spread one and a half inches thick, and while it is hot a coating of crushed rock and sand is spread over and rolled in, making a total thickness of two and a half inches.

BOTH Edison and Tesla have been closely engaged in studying the Roentgen X-ray discoveries with the result of adding many important discoveries to the original. By the "fluorescent screen" Edison succeeded in getting astonishing results without increasing the electric intensity, saving time in exposure and producing results which might be seen by the naked eye. His inventions are along the practical line, and it is announced that his discoveries will not be patented, but are given for the free use

of the public. Tesla has worked in the direction of increasing the electric intensity. Where others have used voltage recoined in thousands or hundreds of thousands, he has used millions. His object was to secure vast power in the vacuum tubes and he has succeeded. A news telegram tells of his accomplishments in these

astonishing statements:

"The skeleton of one of his assistants, who stood at a distance of five or six feet from the tube, which was giving off rays, was seen plainly. But that was not all. Tesla has finally perfected the X-ray tube to such an extent that he saw completely through skeleton as well as flesh. One of his assistants held a brass plate in front of his chest, moving it up and down. The X-ray had penetrated the body, and through the fluorescent screen Tesla could distinctly see the brass plate as it moved.

A NEW machine which bids fair to revolutionize the cigar-making industry is reported from Binghamton, N. Y. Machines are said to be on exhibition in operation there now, which are turning out smoothly bunched and neatly wrapped cigars at the rate of three thousand per day for each machine. This is about three times as many as an expert can roll when using moulds. The machine is of about the size and appearance of a sewing machine and is as easily operated. The essential mechanism consists of a metal plate, a traveling rubber belt and two rubber rollers. The plate has a beveled or warped surface of varying sections, on which cigars of all the approved shapes can be made by a simple adjustment of a clamp. A "bunch" of tobacco is inserted between the rollers and the traveling band. At the same time a wrapper is fed upon the plate and automatically guided around the bunch. The "tucking" and "pasting" are done while the next are being rolled, so that two cigars are in process of manufacture at the same time. It is estimated that with these machines all shapes and qualities of cigars can be made at a labor cost of thirty cents per thousand. -New Ideas.

PULSE OF THE IRRIGATION INDUSTRY

IRRIGATION IN CENTRAL KANSAS.

BY A. C. ROMIG.

To irrigate or not to irrigate; that is the question that has engaged the attention of many farmers in Central Kansas for the last twelve months.

In location we are occupying debatable ground; it is not definitely settled whether

we are arid or humid.

From 1892 to 1896 we were decidedly arid; but now that the rains have come we think we are humid; and the hesitating farmer has decided to postpone his irrigation schemes indefinitely. He has a conviction imprisoned in his brain, that in the cycle of years, we have passed the period of drought, and are entered upon the threshold of a series of wet and prosperous seasons; that the dread calamity of hot winds and crop failures are at an end, irrigation unnecessary, superfluous, and an expensive luxury.

The buoyant hopefulness and simple faith of the average Kansan is sublime.

But the true advocate of intensive farming is not so optimistic, and is not so easily swerved from his purpose by doubtful promise of better seasons ahead. Too often in the history of her existense has the great Sunflower State, in emulation of Macbeth's witches, "paltered with us in a double sense, has kept the word of promise to the ear and broken it to the hope." The wary irrigator is not deceived; profiting from his experience of 1895, he is pressing steadily onward to assured success and grander results in 1896.

There is a phase of irrigation, however, upon which we may all agree, the value and importance of impounded storm waters stored for future use or for immediate service in flooding the ground for the plow and seeding; in our prodigal waste of this valuable element we imitate the North American Indian, whose chief concern upon receiving his quota of rations at the agency, is to get rid of them in the most expeditious manner.

Instead of constructing ponds and basins for the conservation of this wealth-yielding fluid, it is our custom to open up the sluice-ways and speed it onward in its race to the sea where it is not needed.

But our people are learning a better thrift, by study of the Orient, where irrigation has been in successful practice for four thousand years, and where no drop of water is permitted to run to waste.

Central Kansans are becoming interested and much is being accomplished in this direction through individual effort by the construction of ponds and basins on the farm.

All over the plains of Kansas there are low-lying flats or gentle gradients, where an indifferent dam, easily and cheaply constructed for temporary use, may serve the purpose of flooding a considerable area of ground, and hold the water imprisoned until absorbed by the soil and well out of the way of plow and seed.

This system of irrigation was in vogue on the river Nile two thousand years ago, and was practiced in a small way in Central Kansas in the winter of 1894–95, and in every instance the result was not only highly satisfactory and the crops phenomenal, but it was a revelation of possibilities within the reach of every farmer however poor.

There is thrift in the conservation of

storm waters.

IRRIGATION ON THE SOUTH PLATTE.

BETWEEN Julesburg, Colo., and Big Springs, Neb., the towns being only a few miles distant either way from the state line, are a number of irrigation pumping plants and also considerable land under ditches.

Starting from Julesburg and going down the valley the first irrigated farm reached is that of F. M. Johnson. Mr. Johnson has paid for his windmills, made a good living and now has about five acres covered with a young orchard and small fruits.

The T. V. ranch owned by Omaha

people consists of several thousand acres of grazing and natural hay land. It is watered by a 14-foot Mogul windmill working a 12-inch pump on a 14-inch stroke. The pump throws $6\frac{1}{2}$ gallons per stroke. It is not intended at present to water all of this ranch, but merely enough to grow fruit, vegetables and alfalfa.

A. J. Walrath, a stock raiser, built a small reservoir two years ago. Has grown plenty of vegetables for home use and now has a young orchard and small fruit such as strawberries, raspberries and

blackberries.

G. B. Hoover, two miles west of Big Springs, is an old settler. He located (windmill) irrigator of Nebraska and it is conceded that he has the largest windmill irrigation plant in the state to-day. It consists of a 14-foot Mogul mill operating a 12-inch pump with 14-inch stroke and throws 6½ gallons per stroke. Sometimes 30 strokes a minute are made. 12-foot Mogul mill working a 10-inch pump with a 12-inch stroke throwing four gallons per stroke. Also a 14-foot steel mill working an 8-inch Mogul pump, 10-inch stroke, and also a 12-foot Leach mill connected to a 6-iuch pump. Mr. Stafford has a reservoir covering two acres five feet deep with water, stocked with black fish. Has a fine four-year-old or-



TWO-YEAR-OLD PRUNE ORCHARD, K. S. D. RANCH, NEAR ONTARIO, ORE.

first on the table land, was starved out and then bought forty acres in the valley. About a year ago he put up a 12-foot Mogul mill working a 10-inch pump. Irrigated about ten acres, raised corn, millet, sorghum, onions, potatoes, and vegetables of all kinds.

Abbott and Kimball and Geo. Thompson, of Big Springs, built a small ditch to water 500 acres of hay land. They cut twice as much hay last year as a result of

watering.

W. T. Stafford's farm is located on the south side of the river, six miles from Big Springs. Mr. Stafford is the pioneer

chard of apple, cherry and plum trees. Has grown strawberries at the rate of 5,000 quarts per acre, on a half-acre patch, in bearing the past three years. This year has planted an acre each to strawberries and raspberries. Has grown blackberries, raspberries, gooseberries and currants with great success. Has grown 8,000 cabbages per acre averaging five pounds per head, and 400 bushels onions and 200 bushels potatoes per acre. Has also grown large crops of millett and sorghum. At the present time Mr. Stafford has 50 acres irrigated, but thinks he has enough water to cover 70 acres when the ground is leveled. He

began irrigating in the spring of 1891 and has increased his acreage every year since then, He is an enthusiast in regard to the prospects of the South Platte valley. One of his ideas is that the state of Nebraska should offer a prize for the best planned and operated 20-acre irrigated farm.

John Kortz settled on table land but was obliged to abandon it and locate in the valley. He has a few acres irrigated by a windmill and grows plenty of garden truck for home use. This spring Mr. Kortz planted a nice orchard. Part of Mr. Kortz's land lies under the canal described below.

The Miller and Warren ditch starts about seven miles west of Big Springs, is seven miles long and covers about 4,000 acres of land. The ditch is sixteen feet wide at the bottom and two feet of water at the head. It is practically completed and water will be turned in by the time this appears in print.

George Warren, an old settler and one of the owners of the ditch, has a nice farm and will irrigate it from the ditch. The land of R. Beach is also under the ditch. He has a promising crop waiting for the water. Mr. Miller, also a stockholder in the ditch company, has a large body of

land under the canal.

Abbott and Kimball have a fine stock ranch on which is a grove of trees grown by means of pump irrigation. They are large stockholders in the new ditch and are the most enterprising business men of Big Springs.

Big Springs is a growing and thrifty town of 200 inhabitants, with a church, school, stores, hotels, livery and other in-

dustries.

THE CONGRESS REPORT AGAIN.

I notice in the May number of The Irrigation Age a letter from Fred L. Alles, ex-secretary of the Irrigation Congress, in regard to the reports of the fourth congress held in Albuquerque last September.

It is due the members of the Fourth National Irrigation Congress that an explanation be made as to why this report has not been sent out. The local committee and the territorial committee each had a fund to draw on. The local committee had the funds subscribed by the city of Albuquerque, and the Territorial Commit-

tee had the \$2,500 appropriated by our Legislature. The Territorial committee in the division of work and expenses agreed upon between the two committees, were to publish the reports. I have had many letters asking for these reports, which I have referred to Col. Max Frost, president of the Territorial committee, Santa Fe. Some two months ago Col. Frost wrote me that 500 copies would be ready for distribution in "a few days," since which time I have heard nothing. I think if those wishing these reports will write Col. Frost, he will accommodate them with a copy.

I make this explanation because I feel it due to our own people, who responded so nobly to the Committee's call for money and help to entertain the Fourth National Irrigation Congress, that no false or erroneous ideas get abroad as to why these

reports are not out.

I may say that the death of Hon. Walter C. Hadley, secretary and treasurer of the Territorial committee has no doubt delayed an earlier issue of the report.

J. E. Saint, Chairman Local Com. Fourth National Irrigation Congress. Albuquerque, N. M.

A GLANCE OVER THE FIELD.

ARIZONA.

Phænix wants a packing house with ample cold storage.

The Highland canal has had plenty of water this year, and farmers under it are jubilant over their flattering prospects.

The 700-foot tunnel on the Rio Verde canal is completed, so that the twenty miles of canal already finished can be utilized.

The proposed Hudson reservoir will have a capacity of 900,000 acre-feet of water. Some of it is needed now; all of it will be needed in the future.

The strawberry growers around Phœnix have entered into an arrangement by which all fruit is placed in the hands of a single merchant, thereby controlling and regulating the price. The berries are of superior quality; it is claimed they are much finer than California fruit.

A bill has recently passed Congress, and has become a law, under which university and school lands of Arizona may be leased under such rules and regulations as may hereafter be prescribed by the legislature of the territory. Until the legislature acts the governor, secretary of the territory and territorial superintendent of public instruction shall constitute a board to lease said land. Leases cannot be made for a period to exceed five years.

CALIFORNIA.

Ontario wants a cannery establishment. Broom-corn raising is to be undertaken at Whittier.

A horse market has been established at Los Angeles.

The California Raisin Association has been incorporated at Fresno.

Since 1894 not less than 1,000,000 olive trees have been set out in the state.

The grain crop in Southern California is not promising very large return this year.

Redlands has shipped 725 carloads of oranges this year, and has obtained very satisfactory prices.

Three hundred carloads of celery have been shipped from one station in Orange county this season.

Five carloads of machinery and appliances were recently received for the new cannery establishment at Fresno.

Since the opening of the new tourist hotel at Redlands some dozen sales of real estate have been made to its guests.

The little city of Hemet is thriving. They are making large sales of land under its canals, and many public improvements.

Redlands entertained twenty-four carloads of hotel men at an orange lunch on the occasion of their recent visit to the coast.

Sale of the Alessandro town site property was ordered off by the superior court. The company was successful in opposing the sale.

The San Francisco and San Joaquin valley road is nearing completion, and the making of a freight tariff is receiving the attention of its officers.

An insect mite has appeared which bores ragged holes in the back of the scale bugs, and it clears the trees in an orchard of the scale pest in a single season.

The fruit exchanges are proving to be the salvation of the orchardists. While they may grow no better crops, they are getting better prices for them. They are selling water at Hemet at from two to three cents an inch, it is so plenty. The News truly says that water at three cents an inch is just like finding it.

"White Hat" McCarty's fine horses have been removed from Stanislaus county to some choice pasturage near Fresno, where they will have a permanent home.

Another irrigation dam has been blown out in Tulare county as the outcome of antagonisms among the property owners. It is rather an expensive method of venting spite.

The earliest shipment of cherries ever made from the State was sent from Suisun to Chicago, April 3. The previous record was April 27. The shipment was of fine quality and size.

An experiment is being tried in a damp place in the Cajon Pass in cranberry raising. One hundred plants have been obtained for trial. If they succeed it will introduce a new industry on the coast.

Land owners in the Alessandro valley are developing water around the edge of the valley by clearing the cienegas and sinking wells. The exorbitant prices that are being charged for water is compelling them.

A great public market is one of the new things under discussion at San Francisco. Railway and river transportation companies are favoring the plan, and a location on one of the wharves is likely to be selected for it.

The Chino ranch has been sold to an English company for \$1,600,000. Mr. Gird will retain a considerable interest in the property and will still be a factor and moving spirit in its management. This does not include the beet-sugar plant.

The Riverside Press says: "Growers who have sold little lots of grape fruit this winter at phenomenal figures are sorry they had not planted this fruit in larger quantity a few years ago. A carload at \$8 a box would foot up \$2,500 or more.

Dr. R. D. Davidson, county veterinary surgeon, is treating "blackleg" and "anthrax" successfully by inoculation. He sent directly to the Pasteur institute in France for the virus used. The expense is small and the treatment promises to become general.

Covina orchardists and berry men are protesting against a proposition on the part of the Azusa water company to raise the price of water during the coming season. There is a decided tendency all through Southern California to increase the water rates.

Ontario claims to have produced the biggest, heaviest, juiciest lemon ever grown between the north and south poles of this hemisphere. It weighs twenty-one ounces and its two measurements are $14\frac{1}{2}$ and $13\frac{3}{4}$ inches respectively. Redlands denies, and claims one bigger by four ounces.

Large orders, covering practically the entire season's crops, have been received by the Los Nietos Walnut Growers' Association. The success of the association has been gained by organization and the World's Fair exhibit, which created a demand for the California product.

A. R. Smiley, of Redlands, offers \$200 in five prizes to the persons in that city who shall maintain the neatest and handsomest grounds during the coming year. The object is to encourage the planting of ornamental trees and shrubs, and thus add to the attractiveness of the place.

COLORADO.

Some of the leading potato growers in Weld county have been getting in new potato seed of improved varieties.

There is a twenty-five per cent increase in the grain area of the San Luis valley, and of 100 per cent in alfalfa this year.

An ice gorge in the Rio Grande carried away five bridges, and the Riverside railroad bridge was saved by the use of dynamite.

The acreage of trees planted in the Grand valley is greater than ever before this year, and the stock has been better selected and of better quality.

State Engineer Sumner has issued a letter of instructions and advice to users of irrigation waters, in view of an expected scarcity the present season. The snowfall has been light in the mountains.

IDAHO.

The Galloway ditch, near Weiser, is being enlarged to add to its capacity for this year.

The Statesman is advocating the organization of a state fair association and, of course, wants it located at Boise.

An active fight is in progress between the American Falls Canal and Power Company and the People's Canal Company for the control of the lands available for irrigation near the American Falls. The state appears to side with the first-named company, and the Interior Department in its rulings favors the state.

Work on the canal of the Lewiston Water and Power Company is progressing rapidly and it is expected that water for irrigation will be turned in early in June. The ditch begins six miles above Asotin in Washington and takes water from Asotin Creek. There is an immense amount of flume construction involving the use of hundreds of thousands of feet of good Oregon fir lumber. This is one of the largest enterprises being carried on in Idaho at the present time. E. H. Libby is president and C. C. Van Arsdol, chief engineer.

KANSAS.

The "Populist" weed hoe is a new invention intended to save a man from backache — a great invention.

Alfalfa seed has been so scarce and the price so high, at Garden City, as to interfere with the planting which was intended.

The Wichita Eagle says "Possibly this is a year in Kansas when the calamity howl will have to be postponed on account of rain."

The creamery at Harper is now using 80,000 pounds of milk a day and its payments to the farmers foot up \$1,000 monthly.

Six inches of water fell in less than a quarter of an hour in Dickinson county recently. It is hardly necessary to add that it gave the ground a thorough wetting.

The Garden City section was visited by a thirty-six-hour rain with a precipitation between three and four inches, wetting the ground deeply so that the prospects for a good crop were never better.

A co-operative congress, for the purpose of uniting the various co-operative enterprises of the state into one body for educational, social and business advancement, was held at Topeka, April, 9, 10, and 11, under the auspices of the State Farmers' Alliance. Many interesting papers were read, a state association was organized

electing C. B. Hoffman, Enterprise, chairman; O. B. Wharton, Emporia, secretary-treasurer; Alonzo Wardall, Topeka, chairman of executive committee.

The Kansas Immigration and Information Association, of which W. C. Edwards, secretary of state, is president, announce that their "Kansas Souvenir" is now being printed, and will be ready for distribution soon. This will be one of the most valuable books about Kansas, relating as it does to everything of interest in the state. The articles will be from the pens of the most noted writers, among them:

Ex Senator John J. Ingalls, Governor Morrill, F. D. Coburn, secretary board of agriculture, Geo. T. Fairchild, president agricultural college, E. R. Moses, chairman national irrigation executive committee and many others. Every industry in the state will be fully and carefully treated. Copies can be obtained from W. C. Edwards, the secretary of state, Topeka.

NEBRASKA.

Nebraskans think they are marching to prosperity this year.

There are 9,000 acres planted to sugar beets this year and the industry is a growing one.

Senator W. R. Akers has been elected State engineer in place of R. B. Howell, who has resigned.

More than one thousand applications for ditch privileges have been filed with the state board of irrigation.

Arbor day is not a dead letter in this state. Over a million trees were planted in its daylight hours. Liberal premiums were offered by societies and individuals for the largest planting.

The additional mileage of canals proposed under the new irrigation (Carey) law between April 4th and December 31st of last year, amounted to 2,113 miles, estimated to cost \$6,209,285, and to cover 2,367,689 acres.

The Southeastern Nebraska G. A. R., Reunion will be held at Falls City, Neb., July 20-25, and a number of notable speakers are promised for this occasion. Wm. Reece, the secretary, has issued a general invitation to old soldiers and their friends.

The abundance of subterranean water this year is matter of general remark, and where the earth has been destitute of moisture to considerable depth during the past three years, water is now so near the surface as to appear in post-holes immediately they are bored.

The Nebraska Irrigation Fair at North Platte, October 9, 10, 12, 13, 14, 15, 1896, promises to be one of the most important meetings ever held in the state. The officers and board of managers are all working very hard to make it a great success. Buffalo Bill's Wild West Show will exhibit at North Platte during the Fair.

It is expected that work will begin soon on the Great Eastern Canal which will cover a vast amount of land in Eastern Nebraska. The canal starts in Nance goes through Platte and Colfax counties and extends into Dodge county. H. E. Babcock, of Monroe, is the president of the company and very enthusiastic in regard to the matter.

NEW MEXICO.

One farmer in Mesilla valley is planting 150 acres to tomatoes.

The water company at Santa Fe is preparing its splendid farm lands near the government Indian school for a big acreage of Kaffir corn and sugar beets.

There was a snow-fall of unusal depth covering the Santa Fe section and northern New Mexico, about the middle of April, insuring full streams for irrigation and a prosperous season.

Santa Fe is congratulating itself that a bill has passed the United States senate granting the Fort Marcy reserve to the American Invalid Aid Society to be used for purposes of a national sanitarium for pulmonary sufferers.

The Santa Fe New Mexican is getting out an edition of 50,000 copies of a twenty-page paper which will present the resources of the entire territory in a comprehensive way. Cheap immigration literature is in demand, and the publishers are promised a liberal patronage.

M. W. Mills reports a heavy fruit crop on his large orchards in the Red River valley. He has been supplying pretty much all of northern New Mexico with fruit for a number of years and is reaping rich reward for his enterprise in setting orchards when nobody else had the courage.

For several months very careful prospecting has been going on to discover all the resources available to justify the construction of the railway between El Paso and White Oaks. The work has been very thoroughly done under the direction of Mr. Chas. B. Eddy. From the fact that purchases are being made and options closed for coal mines at Salado, and from other indications, it is believed the results are satisfactory and that the road will be built.

The contemplated International Dam at El Paso, Texas, which was referred to in our last issue, is causing some excitement among the residents of the Rio Grande Valley above El Paso, who are petitioning congress to consider the advisability of erecting the dam at some point higher up the river, whereby they, as well as the El Paso people, would be equally benefited. The matter will come before congress next session and is likely to attract considerable attention, not only to the International Dam itself, but also to the general question of government approprations for the erection of dams for the purpose of reclaiming arid lands.

UTAH.

More than 100 carloads of very fine cattle are being shipped out from the range south of Moab over the Rio Grande and Missouri Pacific roads.

There is a pronounced movement in the Cache Valley in the direction of establishing dairies, and a packing house at Logan is also under discussion.

The movement of stock cattle to Montana and the Dakotas will be greater this year than ever before. At least 200 carloads are to be moved from southern Utah to Butte. Shipments will commence about June 1.

The Rio Grande Western is surveying a branch line from Provo to Park City, which it is expected will be built this year. In all parts of the state new enterprises are taking root, and railway extensions are incident to them.

Among the bills passed near the close of the legislative session just closed was one providing for the organization of drainage districts. It is along the line of the irrigation district laws of California, which have become so generally well known. The last were, however, copied after the drainage district laws of the same state, which had preceded them.

WASHINGTON.

The spring was very late.

Yakima valley suffered by severe injury to the fruit buds by spring frosts.

A new creamery is being established at Wenatchee, the first one in that region.

Many new settlers are going into the Entiat valley. Work has commenced on the Entiat Company's ditch, and several hundreds of acres will be planted this year of the reclaimed land.

Paul Schulze promises to rank among the embezzlers, as H. H. Holmes does among murderers. He had previously been credited with stealing \$1,500,000 from the different enterprises with which he was associated, and now it appears that he got \$600,000 more from a St. Paul syndicate.

The Columbian Portage company is proposing to cut present railway rates in two but asking those who will be benefited by the reduction to take stock in the enterprise. It is wise to get the commitment before the building for the average citizen feels but little obligation to pay for that which he can get without.

WYOMING.

There have been distributed from the state hatchery at Laramie, 700,000 of brook and rainbow trout to different counties of the state.

Seventy-five families are settling in the Jackson's Hole country this spring. About one hundred families went there last year and have been successful in cattle raising and farming. Three troops of cavalry are within reach affording protection against the Indians.

Suit has been brought by Gibson Clark, U. S. district attorney, in the name of the United States, against the receivers of the Union Pacific Railway Company. Lands to the value of \$1,000,000 are involved. It is claimed that the railroad company sold lands as under its grant to which it was not entitled. Two hundred settlers are joined as defendants, but the railway company

will defend the suit for all parties concerned.

The state board of control is making provision for extensive surveys in all of the different irrigation districts of the state. Applications for leases were filled for about half a million acres of land. The state constitution adopts a minimum sale price of \$10 an acre, which is above its market value. As it leases at from five to ten cents an acre it is altogether better to lease than buy. There were about 275,000 acres under the government grant of state lands still to be selected. When the total is selected and leased, the state will get an income from it of about \$20,000 a year.

GENERAL MINING NEWS.

Under the new law in Utah the cost of incorporation papers is twenty-five cents on each \$1,000 of capital stock.

The old mine at Barnack, Montana, is being fitted up, and is to be started on ores from the mines of the camp.

A Utah mining man has invented the Acme Gold Amalgamater which is being tested at the Carrington bar on the Snake river.

Anaconda is to have a plant for the manufacture of sulphuric acid from the smelter smoke, for the present only for the company's own use.

The Salt Lake Tribune has recently published a twenty-four page, 300,000 edition, devoted to a detailed write-up of the prosperous Mercur camp.

American mines are again attracting a good deal of attention in London. Prominent experts and South African miners are coming to America this spring.

Superintendent Treweek, of the Mercur mine, says he is ready to increase the output of the bonanza to 1,000 tons a day any time the management provides for the handling of it.

There are at present eleven smelters running in Colorado. All of them are now receiving twice the amount of ore they received last year, indicating that the output is doubled.

The big copper plant that has been standing so long unfinished at Salt Lake City, because of factional fights among its owners, is to be completed and put in blast by June 1 to 15.

While the DeLamar mine in the Mercur district, Utah, does not give out figures for publication, it is contended that it is producing more gold than any other single property in the country.

While sinking a well for water at Cerrillos, New Mexico, oil was struck at a depth of 110 feet. It was not in paying quantities, but the work is to be prosecuted in the hope of making a rich strike.

The Silverton Northern Railway is being constructed between Silverton and Mineral Point up the Animas valley, Colo. It will furnish shipping facilities for twenty gold-producing gulches, where there are many mines already in operation.

The Trail Creek district of Washington is coming to the front and will show a very heavy output before the close of the year. It is estimated that the average will not be less than 400 tons a day of \$40 a ton ore, or \$16,000 a day.

Placer mining will be prosecuted in all of the states with great vigor the present season. New finds are being made and new methods of saving the gold, so that the output promises to be a large factor in the total gold production for the year.

The Power Development Company in the Kern river valley, California, is expected to practically dry the river bed in seasons of low water, and many mining locations have been made along the riverbed with a view to placer washing at such periods. It is known that there is plenty of gold in there yet.

The most valuable single carload shipment of ore that has probably ever been made has recently been shipped from the Eureka Hill mine, Utah. Twelve and a half tons were valued approximately at \$375,000, there being sufficient gold in it to bring it up nearly to coin value. It was the product of the mine for about three months.

The district surrounding Baker City, Oregon, is becoming one of the important gold fields of the West, and development work is in progress there on a scale never before known. Capacity of mill and mining plants is being increased, new mills are being erected, additional men are

being employed and there is generally a wholesome condition.

The Mammoth Mining Company, of Utah, has recently struck a body of ore at the 800 foot level equal to that which gave the property its reputation in its palmiest days. Much of it yields as much as 100 ounces of gold to the ton, and the silver ore yields as high as 1,400 ounces. Twenty new stamps are being added to the mill, making a total of sixty.

There are to be two cyanide plants constructed in the Mercur district, one by the Mercur and the other by the DeLamar, each with a capacity of 500 tons per day. Other mills are being built in the same district. The process is one calling for a comparatively small outlay in the plant. The ore bodies are enormous, and although of low grade the cost of treatment is so small as to leave a handsome margin of profit.

An article by Robert A. Kirker, published in the Grand Junction, Colorado, News, advocates the establishment in that locality of an Oberstein lapidary factory. He makes the broad statement, and challenges contradiction, that there is in that locality a superior quality of raw products of agate, onyx, jasper, chalcedony, etc., more beautiful and in greater variety of olor, without flaws or imperfections, than can be produced by any other lapidary locality or manufacturing site now established in the old world or in America. His article is a very interesting one, and indicates a comprehensive knowledge of the industry.

The cathode ray is finding its adaptation for a great variety of purposes. cently some very interesting experiments were made in Oregon City, Oregon, by Dr. J. C. Ferry, a well-known physician there, and W. C. Cheney, superintendent of the Portland General Electric Company. The rays were made to define the free gold in gold-bearing rock as plainly as if lying on the surface of the quartz. This is probably the forerunner to a general use of it in mining operations. If they go on improving it as they have for other purposes, it will not be long before we shall hear of it being used to explore the ground between tunnels and the surface above.

BOOKS AND MAGAZINES.

GLADSTONE, HALE, FARRAR, GUNSAULUS, ETC.

No matter what the subject might be on which the men whose names are given above might write it would be of absorbing interest to the people. How much more would this interest be if the subjects on which they wrote were those to which these men had given the greatest consideration and the best thoughts of their minds. In "The People's Bible History," just issued by the Henry O. Shepard Company, of Chicago, the matured opinions of these men-of the most learned Biblical scholars in all portions of the globe---is concentrated. Of this book Bishop John H. Vincent says: Gladstone and Sayce have written expressly for its pages, giving the latest results of their largest knowledge, is enough to justify even the most cultivated people among us in the purchase of this admirable book, and the English ex-premier and the eminent English archæologist are only two out of eighteen specialists who have contributed to 'The People's Bible History." The beauty and wealth of illustration and the exquisite presswork and typography of the book are worthy settings to the utterances of the great minds set forth in its pages. The popular edition of the book is to be had in cloth, half russia and full russia. Agents are wanted. An edition de luxe has also been brought out, containing 1,283 pages and 200 full-page illustrations and maps, and is said to be a masterpiece of modern bookmaking.

"The Education of Women in Turkey" is the interesting theme of an article by Miss Mary Mills Patrick, President of the American College for Girls, Constantinople, whose educational work among the women of Turkey, extending over a number of years, entitles her to write with authority on this question. Professor Thomas Davidson, who has just returned from a two-years' sojourn in Europe and the East, has written a highly interesting article for this number entitled "The Democratization of England," for the June Forum.

An entirely new near view of Grant will be given in McClure's Magazine for June, in a paper written by the man who was chaplain of the Twenty-first Illinois when Grant was colonel of the regiment, and who lived during that time in the closest intimacy with him. It reports interesting conversations with Grant and relates a number of characteristic anecdotes. In this number Elizabeth Stuart Phelps will have a paper of reminiscences of Harriet Beecher Stowe, who was her neighbor and helpful friend in Andover, and of James T. Fields, her literary adviser and publisher. The paper will be illustrated with some rare portraits and other pictures.

With its rubricated initials, its fifty beautiful illustrations-of which six are in a rich photo-tint-its marginal decorations and interesting letter-press, the Land of Sunshine, of Los Angeles, California, is very much the most attractive number yet issued by that progressive magazine of the great Southwest. The romance and mystery and beauty of California, Arizona and New Mexico find in this handsome monthly such expression as they have never had before. Pictorially it is much ahead of anything else in the West; and it is made to be read as well as looked at. Its contents are crisp, competent, characteristic and always readable. The best writers in the West (and some of the best in the East) are among its contributors.

The second article on "The Trotting Horse," by Hamilton Busbey, in the June Scribner's, contains more remarkable illustrations of great trotters. Among the most beautiful in this issue are Sunol, Azote, and Electioneer. The great stock farms of Stony Ford and Palo Alto are also described and illustrated.

The wombat is a little animal resembling in appearance a small bear, with short legs, a broad, flat back, and very short tail. It eats grass and other vegetable matters and is a harmless little creature, shy and gentle in its habits, though it can bite if very much provoked. In the May "Chatterbox" there is a story of a farmer who had a wombat for a pet; he took it a long way into the forest in order to get rid of it, but twice the little animal returned, having found its way without help to its adopted home. The third time the farmer conveyed it across a deep and broad river, and as the wombat cannot swim, he felt sure he had gotten rid of the persistent

pet; but no! the little creature soon found a huge fallen tree, which lay half across the stream, and crawling to the extreme end, sat wistfully gazing at the departed farmer. So touched was the man that he paddled back again, took his fat little passenger on board, and carried it home, much to the delight of the children.

[Estes & Lauriat, publishers, 196 Summer street, Boston, Mass., fifty cents a year or three months for ten cents.]

A COLORADO RANCH.

The Wallace Ranch in Colorado is eight miles east of De Beque on the south side of the Grand river. It consists of 480 acres all in a fine state of cultivation, watered by a mountain stream which furnishes abundance of water for irrigation. This stream has its source on the high table mountain known as Battlement Mesa. The top and sides of the mountain are covered with grass and timber. The grass of which there seems an almost unlimited supply is used for the pasturing of domestic cattle, and the timber furnishes shelter for plenty of large game such as elk and deer.

From the top of a near by mountain can be seen toward the east the snow-covered peaks around Gunnison and Aspen, while to the southwest can be seen the LaSalle and Henry mountains in Utah.

This ranch is just at the gateway where the creek has forced its way through the mountains and out on to the level mesas, where there is fine farming land only waiting the magic touch of water and cultivation to blossom and bring forth abundant harvests.

The best method to grow corn in one locality may not be the best in another. Careful study must be given to the local conditions. For this as well as for almost everything else the farmer has to do, it is necessary to give careful thought.

It takes less time to keep the chickens and stock healthy by preventing the sickness than to cure it, and costs less, too.

A fresh cow in lambing time will beat a creamery for profit.—Dakota Farmer.

Weeds are robbers of plant life. Exterminate them.

MANUFACTURES AND TRADE

FOREIGN COMMERCE OF THE UNITED STATES.

From official sources we collect the following statistics showing the volume of our foreign commerce for a series of years:

			Total
	Exports.	Imports.	Commerce.
1889	\$ 742,401,375	\$745,131,652	\$1,487,533,027
1890	857,828,684	789,310,409	1,647,139,093
1891	884,480,810	844,916,190	1,729,397,000
1892	1,030,278,148	827,402,462	1,857,680,610
1893	847,665,194	866,400,922	1,714,066.116
1894	892,140,572	654,994,622	1,547,135,195
1895	808,059,419	743,742,849	1,551,802,259

The figures given are for the fiscal years ending with June 30, and it will be seen that our foreign commerce attained high water mark during the year ending with June, 1892. A change of tariff schedules has taken place during the time under review, and a violent convulsion in the financial world has also occurred; yet all causes combined have not so very seriously crippled our foreign trade, as the above figures will testify. The ultimate effects of recent tariff legislation cannot yet be foreseen, but they are almost certain to increase the imports if they do not diminish the exports.

SOUTH AFRICAN MINING IN A NUTSHELL.

Probably not since the days of John Law and his celebrated "Mississippi Scheme," has the general public of England and France especially, gone into wilder or more hopelessly reckless speculation. The mining stocks of the Johannesberg region in South Africa formed the basis of innumerable wildcat concerns which have drained dry the stock markets of both England and France. Beyond a certain point, however, sensible people who stop to think a bit, know the whole business to be insane folly. Anyone reading the following figures from the London Statist, reprinted here from Bradstreet's of recent date, can see at a glance how hopeless is the prospect of dividends from West Kaffir mining shares: the end of 1893 the capitalization of the Witwatersrandt mines, on the basis of the market price of the shares, was about £17,500,000, the return in dividends £1,-000,000. At the end of 1894 the capitalization was about £55,000,000, and the return in dividends about £1,500,000. The present capitalization of the whole of the mining companies having their field of operations in South Africa cannot be far short of £300,000,000, while the actual dividends for 1895 were not more than £2,500,000." Certainly, dividends of only five-sixths of one per cent. should not be very enticing to investors, even in these days of low interest.

SOMETHING ABOUT BANANAS.

It is believed by many lovers of bananas that if they could only eat the fruit directly from the plant they would find it incomparably more delicious. This is an error. Even on the plantations where grown, bananas are never allowed to ripen on the stalk. Like our pears, the banana is much better if taken from the stalk when mature, but not ripe, and allowed to ripen elsewhere. The banana stalk bears but one bunch of fruit, and is always cut down in harvesting that bunch. "Suckers" continually spring up from the roots of the banana, hence the crop goes on, one sucker after another coming up to bear its bunch of fruit after those preceding it have been cut down in the process of har-The main sources of supply for bananas coming to the United States are Jamaica and the eastern coast of Central America. From Port Limon, in Costa Rica, a good many thousand fine bunches come in every year, and also from the region of Bluefield and the Escondido river, in Nicaragua. But the largest shipments are from Jamaica. For the year 1894 the value of bananas imported was \$4,960,747; and for 1893 it was \$5,386,-029.

FREE ENTRY OF FOREIGN FRUIT BOXES MADE OF AMERICAN MATERIAL.

Everything seems to be interpreted in favor of the foreigner when it comes to the construction of our present tariff law. Not long since the Board of Appraisers at New York, who knocked the duty off Grecian currants recently, made the fol-

lowing ruling regarding foreign orange, lemon and lime boxes made of American shooks:

"In view of this doubt as to the proper construction of the law, the rule would obtain, as often announced by the Supreme court, that the benefit of the doubt should be resolved against the government and given to the importers. This would authorize the conclusion that imported orange boxes, which are made entirely of American shooks, previously exported filled or empty, would be free of duty under said paragraph 387.

"This construction we accordingly place upon the law, and, in harmony with such interpretation, we modify decision in re Haynes, G. A. 2855, sustain the protests and reverse the collector's decision in each case, with instructions to reliquidate

the entries accordingly."

The effect of this ruling will be to lower the duty on foreign citrus fruits a few cents a box, thus still further cutting into the American producers of these fruits. Perhaps the day may come when we shall have a tariff law specially favoring American producers as against foreigners. At present the latter appear to have things very much their own way.

COTTON SPINNING IN JAPAN.

Statistics published recently by the government of the United States show that in 1887 only 19 cotton spinning factories with 70,220 spindles were to be found at Kobi, Osaka and vicinity; while in 1893 there were 40 establishments numbering 381,781 spindles, and producing 87,667,324 pounds of cotton yarn. In 1894 the output was 90,000,000 pounds. In February, 1895, there were 47 cotton spinning establishments, with 492,979 spindles and the number is liable to be greatly augmented in the near future. 1894, the value of spinning machinery for cotton and silk imported into Japan was \$1,445,000. It is of interest to note that in Japan, male cotton spinners receive but 8 cents a day while female operatives get but 5 cents a day. Some day our own spinners as well as those of Great Britain will have to compete with the 5-cent spinners of Japan.

The wettest place in the world is Cherrapongee, in India, the annual average rainfall there being 610 inches. In 1861, the downpour at that point reached the marvelous figure of 905 inches. The average annual rainfall for the globe is 36 inches, and the mean annual temperature is 50 degrees Fahrenheit.

The hottest city in the world is Calcutta, India, where the mean annual temperature is 82.4; the coldest inhabited place is Tobolsk, Russia, with a mean annual temperature of 32. The average temperature of St. Petersburg is 39.6, and of Moscow, 40.

The line of perpetual snow under the equator is 15,260 feet above the level of the sea. In latitude 70 it is but 1,278 feet above sea.

In spite of the fact that we hear continually that Australia is overrun by rabbits, they are quoted in the Melbourne market at 24 cents per pair, and hares range from 24 cents to 36 cents each. These prices are quoted by United States Consul Maratta.

Consul Germain, at Zurich, Switzerland, reports to the State Department that the female operatives in the knitted underwear factories in Switzerland get an average of 29 cents per day. He visited a factory employing about 500 girls and women at these wages, and was informed by the proprietor that each of them had an account in the savings bank. Large amounts of this underwear are imported into the United States from Switzerland.

Mulhall, the great English statistician, alleges that at the death of Augustus Cæsar, the population of the earth was but 54,000,000. That of Europe before the fifteenth century did not exceed 50,000,000. The world's population is now estimated at 1,479,729,400, that of Europe being 357,379,000.

The Royal Geographical Society of England gives the earth's area at 196,-971,984 square miles, and its cubical contents at 259,944,035,515 cubic miles.

One-quarter of all the people born upon the earth die before reaching the age of six years; one-half before reaching the age of 16, and only about one person in each 100 born lives to the age of 65.

H. C. Welty, of Topeka, Kansas, one of the most prominent well-drillers in the State is an advocate of irrigation by means of wells and pumps and wherever possible by artesian supply. Mr. Welty was the organizer and moving spirit in the Welldrillers' convention last year.

TOPICS OF THE TIME

Mutual There are no two classes in the Interests. community whose interests are so intimately woven together as the manufacturer and the farmer. The one cannot prosper without the other does. That the farmer has suffered out of proportion with other classes during the past few years any one who has given study to the matter is compelled to admit. At present prices for farm products the return for the farmer's labor is rarely enough to provide the absolute necessities for his family. Opinions may differ as to the cause of low prices, but the farmer of the west believes it is largely due to the manipulations of the world's financial markets, by which silver has been depreciated in price relative to gold. So long as the surplus of farm products seeks a foreign market, the price of that surplus in great measure regulates the price of the entire product. If we sell our silver bullion as a commodity for half its former price, and it can still be used as money to buy farm products in other countries in the same quantity as at its former price, it goes without saying that our farmers must compete with those products and must, therefore, accept half price for what they raise. It will not help the manufacturer very much to give him any measure of protection by tariff unless at the same time the great mass of his customers are put in a position to purchase and consume his wares. The principle of protection is not one that should have simply a local application. Every industry should have its due recognition, and where there is such pronounced mutual dependence there should be equally a mutual help, in behalf of such legislation as will promote the interests of all.

Official It is a highly commendable Reports. work that state engineer Mills is undertaking to do for Idaho. He has sent out over the state hundreds of circular letters accompanied by blank forms to be filled out by the parties addressed. The information so obtained will be compiled as official agricultural statistics of

the state. Heretofore there has been no advertising of the state's resources except by persons interested in colonization. A detailed statement of facts is expected to show that the average yield of nearly all kinds of farm products, in all parts of the state, is much in excess of the average yield for the United States, and coming from a state office it will have much greater weight of authority.

Emigrant The number of emigrants Movement. who arrived in this country in 1892 was 623,684. It gradually decreased until 1895 when it was only 279,-In February of this year the increase began and since then the people have been pouring in at such a rate that Colonel Stumpf, commissioner of immigration at Washington, prophesies that the number this spring will equal, if it does not exceed the record of any previous year. There is also a very heavy movement from east to west, and the movement which has been anticipated for the past two years, as the logical result of the business depression, promises to reach the full tide during the present year.

Lands are The United States Supreme Taxable. Court has confirmed a decision by the state courts of Nevada holding that the state is entitled to levy taxes upon patented lands, and also for lands which have not yet been patented, but which had not been surveyed, and on which the cost of surveying had not yet been paid. It holds that if the railroads have a possessory claim to the lands they are taxable under the statutes of Nevada.

Educational Agencies. The first thing asked and Agencies. Obtained of the state legislature of Utah, in the farming interest, was an appropriation of \$1,500 for the support of farmers' institutes. It may be difficult to determine which is most valuable, the agricultural experiment stations, fostered and aided by the government, or the institutes which are a state

institution, and there is certainly no occasion for rivalries. Both are doing splendid work and in thoroughly practical ways. Money spent for either will bring prompt and large return in developing to best advantage the vast agricultural resources of the state.

Quick Recovery. The orange trees which were cut down by the frost in Florida are making a wonderful growth of wood and the trees will bear a fair crop in two years, instead of losing five as was at first expected. Such rapid growing wood, will, however, be more susceptible to similar injury than the old wood of slower and sturdier growth.

Delayed It has been for some time ex-Decision. pected that a decision was to be rendered in the United States Supreme Court as to the constitutionality of the Wright irrigation act, and the validity of bonds issued under it. Intimations have been given from some source that the court will uphold the act, and it is stated that a New York capitalist has been buying up the bonds at low prices, with the expectation of course that they will advance in value. A decision upon this question involves a very large aggregate amount, and it would be deplorable if a decision should be so long withheld after the arguments had been made, and at the same time there should be a leak which would justify such a speculation. It is to be hoped that the man is only a good guesser.

Important The Caldwell Tribune says Decision. of a recent decision handed down by Judge Richards, of an Idaho district court:

"This decision goes specifically to the question of perpetual rights and while it does not inhibit the sale or purchase of them it amounts to practically the same thing by holding that canal companies must supply water to settlers, at reasonable rates, without perpetual rights, when there is surplus water in the canals. In other words, according to the decision, the canals are common carriers just the same as railroads and the public is not obliged to pay a royalty for the right to engage their services. If the supreme court sustain the district court, which we

think it will, one of the worst evils in connection with the commercial irrigation system will have been done away with. The canal companies then will not be privileged to say, we will furnish water under such conditions as suit our purposes, but they will be obliged to furnish water under such fair and equitable regulations as the courts may determine. If this is the law, the question occurs, has it not been the law ever since the adoption of the state constitution? If it has, may it not open an interesting question on the subject of desert lands? After a canal has been constructed for the purpose of supplying a body of unoccupied public lands, does not that tract cease to be desert land except as to the particular person or persons who constructed the canal? Has the general public right of desert entry when it can be shown that the land is under water which may easily be diverted? It seems to us that under the decision of the land department in the case of the People's company against the American Falls company there might be serious question on this point. However, the water question is gradually working itself out in correct lines and it will soon be numbered among the things that no longer harass and retard development of this magnificent section of the great west."

A Sure Prevention. Chauncey Depew talks on many and varied subjects and generally talks well. His tongue often runs very smoothly with its flattery, and he seems to have given it full play during his recent Pacific Coast trip. In Southern California he said:

"Here is a country destined to drive Italy and the world out of oranges, olives, prunes and wines. Here is a land that will rejuvenate the worn out pilgrim from the far east, and more. Heretofore there has been one dread disease from which no rank or condition has been exempt, but by your seedless Navel oranges you have robbed the race of the terrors of appendicitis."

Consolidated Gradually the fruit growers of California are improving their market facilities. Between a monopolistic railway which has demanded all the traffic will bear and the

combinations of the packers, who have not been bashful in making their demands, the fruit growers have been producing the fruit just for the fun of the thing, as it were. But the natural law of selfpreservation is asserting itself, and by fruit exchanges and other organizations the growers are getting together and are taking the reins in their own hands. They are packing their own fruits and shipping it to their own agencies in the principal cities, and are establishing a market for their well-protected brands. Recently there has been a movement to hold auction sales in three separate rooms at the same time in the Chicago market, thereby dividing the buyers into small groups, restricting competition and holding prices down in the interest of the local purchasers. The Sacramento Fruit Grower's convention appointed a committee of the leading growers to consider the matter - H. Weinstock, of Sacramento; Joseph Martin, H. A. Fairbanks and Wm. Johnston, of Courtland; A. T. Hatch, of Suisun; R. D. Stevens, of Sacramento; and Frank H. Buck of Vacaville. decided unanimously that consolidated auction salesrooms should be established at all the eastern markets, to bring buyers under one roof and stimulate competition.

Security The Senate committee on Authorized. public lands reported an amendment to the sundry civil bill by which a basis of security is established, through the state governments, for money expended in reclaiming lands under the Carey law, by issuing patents authorizing liens upon the land. It may be said here that there seems to be a willingness on the part of congress to adopt any reasonable measure which will assist the reclamation of the lands for which that law was intended, and it is being amended so as to make its execution less difficult.

The Country Senator Cannon, of Utah, in has introduced a resolution in the senate providing for the creation at the national capital of a physical map, which will be two-thirds of a mile long and of a width in due proportion. It is to be laid out on the ground, reproducing every physical feature of the country, including every

lake, river, hamlet, city, railroad and canal, mountain and plain, in miniature, on a scale of a foot square to the square mile. If it can be carried out our national legislators can get a better appreciation of the relative size and importance of the states than most of them possess. It is doubtful, however, whether the eastern people will be willing to make the contrasts so conspicuous.

Planting The State of Michigan has Trees. furnished a large share of the lumber used in the construction of farm buildings and fences in the prairie states east of the Mississippi, and is just now beginning to realize that there ought to have been more trees planted as the grown forests have been cut away. Governor Rich issued a proclamation urging that every person in the state should plant at least one tree on May 1st, if it was at all practicable, and that the public schools make observance of "arbor day." also pointed out the desirability of preserving shade trees along the public roads. It is better the harm be remedied by action in the future than not at all, but foresight which would have prompted it many years ago would have been most commendable.

Object If every fruit grower who de-Lessons. pends on shipments of his products to the great city markets could follow his consignment and note the treatment it gets from the transportation companies, or their employees, it would impress upon his mind the necessity for careful packing to prevent injury by rough handling and neglect at transfer points. If then he would go into the market houses—the commission houses -and see the pressure under which sales must be made and the stuff handled, and how large a proportion of that which reaches the market is in a damaged, and sometimes in really unsalable condition, it would probably be the best investment he could make in connection with his business, both of time and money. There is always demand for good fruit in good condition, but if it is of inferior quality and is badly packed, and consequently in bad condition when it arrives, it is far better to keep it at home and feed it to the pigs.

POINTS FOR PRACTICAL IRRIGATORS

SAND IN IRRIGATING DITCHES.

A correspondent writes for some information upon the best method of preventing a main irrigating ditch from being filled up with the sand and silt that is present in nearly all the streams to a greater or less extent, especially during the winter season.

There are two ways of doing this: By watching the flow of any stream it will be seen that the greater portion of the sand, and that which will cause the most damage if allowed to get into the ditch, is carried at the bottom of the stream in a mass which moves with less rapidity than the water over it. To prevent this moving mass from entering the head of the ditch the headgate should be arranged so that the bottom boards are considerably higher than the bottom of the stream. Planking should be put in perpendicularly across the gate, against which the sand flow will strike. Of course if there is no outlet the sand will quickly accumulate so as to clog the gate. To obviate this difficulty, at one side of the gate put in a waste weir having its base lower than the base of the headgate. Then arrange the gate in the weir at a height just sufficient to allow the sand to be carried away and not permit more water to escape than is necessary to carry the sand.

Of course it will be necessary to give the waste weir plenty of fall before its discharge, else it too will clog up. When an unusual amount of sand is carried into the stream by reason of a storm it is desirable to shut down the headgate entirely until the most of the sand flow is over. But this cannot always be done.

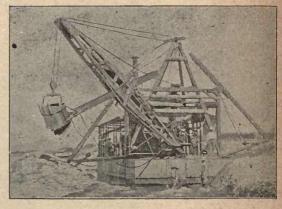
Another way to keep a ditch clear that has a good fall is to put in waste weirs and gates at regular intervals. Then if the ditch begins to clog up, shut down the first gate, open the weir and let the current scour out the ditch. When the first section is cleaned, open the gate and close the next one, and so on until the ditch is all worked out. This plan is in use in Arizona and proved very effective.

But the best way is, if possible, to prevent the sand from accumulating in the ditch, and this can be largely done by the method outlined.

MACHINERY FOR IRRIGATING AND DRAINAGE CANAL.

The accompanying cut illustrates a 1 1-4 Ditching Dredge manufactured by the Marion Steam Shovel Company of Marion, O. This company makes a specialty of Dredges, Ditchers and Steam Shovels. Their attention is exclusively given to this line. Their plant covers 11½ acres of ground, and is equipped with everything in the way of modern machinery that will cheapen, or better the production. Their power is electricity which is generated in the power house and transmitted to the different departments in each of which is a suitable motor.

There is an interesting history connected with the work on which the Dredge illustrated was used; it was used on the Mesa Canal in Arizona. This canal is part of a system of canals that modern engineers claim was first made by a prehistoric race; they also claim that the system was so nearly perfect in all its details that modern engineers have been able to improve on it only in a few instances. When, and by whom it was



constructed, there is no record. Many parts of this system were nearly or quite filled up; but, when cleaned out, the old channel could be plainly traced. deepening and widening this system of canals, very hard material was encountered - much of it being shale rock, and cemented gravel. Many large boulders were found that had to be removed with the dredge. At the point where photograph shown, was taken, the material was hard cemented gravel. The Marion Steam Shovel Company sold a little later on to the same company a very large dredge, capable of depositing the material at a distance of about seventy-five feet from center of machine. This made the equipment of this canal company complete, as they could construct new extensions, or clean out the old channels, be they either large or small, with machinery. It is a fact no longer disputed, that can als are much better when constructed by machinery, than when constructed by old-time methods, for the reason that they do not require so much slope and consequently there is not as much room for grass, weeds, or bushes to accumulate along the banks and obstruct the flow of the water. A large per cent can also be saved on the cost of construction by the use of suitable machinery.

LIDGERWOOD CABLEWAYS.

Spencer Miller, engineer of the Cableway department of the Lidgerwood Manufacturing Company, New York City, has returned from a four-months' visit to Europe much improved in health and bringing with him all the American rights under the patents of the Temperley Transporter which the Lidgerwood Company will immediately place upon the market.

The Transporter is a hoisting and conveying device employing a suspended beam as a trackway. The chief points in its favor are simplicity in operation, low cost and extreme flexibility. No skill whatever is required to operate this apparatus.

About 300 transporters have already been made and the device has therefore passed through its experimental stage.

The British Admiralty have adopted the Temperley Transporter for coaling battleships, having recently purchased nearly one hundred of them. Mr. Miller also secured a contract in Paris from the New Panama Canal company for seven cableways which were shipped April 30, to Panama.

COMMON SENSE IN ADVERTISING.

The advertiser who goes around seeking avenues for announcing his wares to the world, unless well grounded in the basic principles of the art, is apt to be most gloriously fooled. He will soon find himself and money parting company. looks only to quantity in advertising, his separation will come all the quicker. It is a comparatively easy matter to place advertising on the quantity principle, all that is required is the ability to add figures and compare statements. But it is quite a different matter to decide on advertising lines on the standard of quality. There are mediums having a very limited circulation which are to be preferred by a thousand per cent. to those claiming a great distribution of copies, rates being equal. Character of the publishers and reading matter, size and distribution of a subscription list, uniformity of rates and general business methods have much to do with an intelligent selection of an advertising medium. Then, sad to relate, publishers have little tricks which deceive the advertiser, making him believe he is getting "results," when he is simply answering letters from "stool pigeons" placed in different sections of the country to incite the unsuspecting advertiser into the belief that he is having great "returns." That species of wickedness cannot be laid at our door.—Am. Investments.

POINTS.

Even in Dakota irrigation doubles the grain crop, and it pays to sink artesian wells to get the water supply.

Where plants do not grow set new ones in their places at once. Missing hills don't pay.

There is no reason why a farmer should not have something for sale every week in the year.

It is alleged by "Hardware" that a bronze or copper wire rope half an inch in diameter and over 20 feet long was recently unearthed from the ruins of Pompeii where it was buried nearly 1900 years ago.







